HISTORICAL ASPECTS OF HIGHWOOD RIVER DIVERSION TO LITTLE [illegible] RIVER BASIN AT HIGH RIVER

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1. INTRODUCTION

1.1 Background

The town of High River is centered along the divide separating the Highwood River and Little Bow River watersheds. The area of interest and the historic location of this divide are shown in Figure 1. The location shown represents the divide as it was 100 years ago, before it was affected by construction of dikes, landfills, ditches and road embankments.

The situation at High River is somewhat unique in that Highwood River water occasionally spills over the divide into the Little Bow River watershed. The frequency and circumstances by which spillover occurred a century ago, as compared to present day, are topics to be addressed in this study. Since the end of the 19th century, via a man-made diversion system, landowners along the Little Bow River have utilized the Highwood River as a source of water for agricultural and domestic needs.

Support by irrigators along the Little Bow River for the current plan[1] to increase the quantity of water diverted into the Little Bow Canal is based on their opinion that there is historical precedent for natural spillover in the amounts and frequency contemplated. In fact, it is believed by some that there is a reasonable chance the Highwood River might have been 'captured' by the Little Bow River, if a concerted effort had not been made during the last 100 years to prevent this from happening.

An important element in the interbasin flow process is Baker Creek (see Figure 1). This is a Highwood River flood channel that begins 5.6 km southwest of High River town. It runs generally along the southerly edge of the floodplain before it re-enters the river near the Town's west boundary. Most of the historic spillover into the Little Bow River has come out of Baker Creek immediately upstream of High River town.

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[1] The Proposed Little Bow Project - presently at feasibility stage of study.

About 75 years ago there was a growing concern that Baker Creek could become the main channel of the Highwood River[2]. It was feared that this new channel could eventually cut through the divide, and that the river would then be permanently captured by the Little Bow River. To alleviate this concern, action was taken at that time to block off the entrance to Baker Creek by means of a dike along the Highwood River - this dike has since been referred to as the "Hoeh Dike".

Northwest Hydraulic Consultants Ltd. (NHCL) were retained by Alberta Environment to undertake a comprehensive study of the Highwood River to Little Bow River spillover/diversion process. In general, the study was to address the matters and issues outlined above, with a view to providing planners with a reasonably definitive understanding of the interbasin spillover process as it was 100 years ago, and how it might have changed in the years since.

1.2 Study Objectives and Approach

The study Terms of Reference provided by Alberta Environment will be found in Appendix B. The study objectives were to respond to the following points and questions:

(1) "provide an understanding of the Highwood River to Little Bow River interbasin flow process during the last 100 or so years";

(2) "to what extent have human activities (eg. land clearing, road construction, railroad construction, vegetation changes, etc.) affected the interbasin flow process?

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[2] See "Memorandum" dated 2 July 1918, Department of the Interior, Page 2, Paragraph 3 (Appendix C of this report).

(3) why was the Hoeh Dike built and did it meet its objectives and if so, is it still meeting them today?

(4) what would happen if the Hoeh Dike was removed?

(5) why was the Little Bow diversion canal constructed and to what extent was it built to compensate the Little Bow water users for the perceived loss of water due to the construction of the Hoeh Dike?"

(6) "...provide an opinion as to whether a complete or partial river diversion might have occurred this century if the Hoeh Dike had not been maintained."

The approach utilized in the study included the following activities:

(1) Archives were searched for records and factual information concerning the Highwood and Little Bow rivers in the vicinity of High River town. This activity included visits to: the Town museum; a local newspaper (High River Times); Water Survey of Canada (Calgary); and Alberta Environment (Edmonton). Historic photographs, reports, letters and drawings dating back to 1898 were recovered. Selected historic documents have been provided in Appendix C.

(2) A careful ground inspection was made of the spillover areas, diversion sites, dikes, flood channels and road embankments between the Squaw Coulee diversion works and the Town. Two long-time residents were interviewed: Mrs. E. Leach and Mr. D. King - these and similar interviews in a 1974 study[3] provided valuable information.

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[3] "Flood regime study of the Highwood River at High River"; Northwest Hydraulic Consultants Ltd. for Alberta Environment. May 1974.

(3) Water surface profiles were computed for the Highwood River for the reach from the Hoeh Dike to High River town, for flood peak discharges ranging up to the 100-year return period. This involved use of the HEC-2 computerized surface water profile program and the 1974 river cross sections[4]. Cross sections were adjusted to reflect morphological conditions as they might have been 100 years ago. Estimates were then made as to where and when water was likely to begin spilling out of Baker Creek into the Little Bow River watershed. Similar estimates were made for conditions as they exist today.

In Section 2, a historic summary is provided that covers the more important physical elements, channel characteristics and events related to the study objectives. Section 2 also contains the results of the flow profile analysis and an assessment of its applicability to the natural interbasin flow process.

In Section 3, the questions posed in the Terms of Reference, as summarized above, are addressed in relation to the information outlined in Section 2.

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[4] NHCL river surveys from 1989 and a recently completed set of Alberta Environment contour maps were used to upgrade these cross sections.

2. ANALYSIS HIGHWOOD RIVER/LITTLE BOW RIVER SYSTEM

2.1 Post-Glacial Evolution

Figure 2 provides an aerial photo mosaic of the study area. The natural topographic divide separating the Highwood River and Little Bow River watersheds in the vicinity of High River town is shown.

A study of the surficial geology and fluvial morphology by Mollard[5] provides some insight into the evolution of flow channels in the vicinity of High River town. As illustrated in Figure 2, the area south and southwest of the Town is traversed by a series of shallow channels (swales) on what Mollard describes as a "late glacial outwash fan". It is speculated that the presence of a retreating continental ice sheet immediately north of the Town some 13,000 years ago forced all of the Highwood River flows down what is now the Little Bow River valley. This view is supported by the fact that the sizes and shapes of the meander loops in the Little Bow River channel are similar to those of the present-day Highwood River (see "Note" in Figure 2). There is little evidence of scouring or erosion in the many shallow channels south of town which have carried overflow from the Highwood River subsequent to glacial retreat, suggesting that overflow in the last 13,000 years has been infrequent and spread out over the entire outwash area.

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[5] "Geological report, Little Bow Dam Project, Probable Maximum Flood overflow from Highwood River basin to Little Bow River basin"; J.D. Mollard and Associates Ltd.; Ancillary Report 8, Volume II, "Probable Maximum Flood, Little Bow River Dam"; Northwest Hydraulic Consultants Ltd., June 1990 (Draft).

2.2 Historical Developments

2.2.1 Situation in 1898

The planform of the Highwood River in 1898 in the vicinity of High River town is shown in Figure 2 - this representation is based on letters and drawings of that year[6]. Other important features to note in Figure 2 are as follows:

(1) In 1898, the Highwood River over a length of 1 km upstream of the rail bridge consisted of two primary channels: South Channel and North Channel. The bifurcation of these two channels was located at the west boundary of High River, near the mouth of Baker Creek. These two channels recombined immediately upstream of the rail bridge.

(2) Reports of the day refer to the area between the above two channels as "the island". An 1898 survey outlines a path for a proposed cutoff channel through this island[7]. It was thought that a cutoff would eliminate a problem of bank erosion along the South Channel, by relocating the river to an area away from the Town.

(3) A privately owned diversion ditch had been constructed by a Mr. Robertson for the purpose of conveying Highwood River water to his ranch northeast of the Town. We are not certain as to its time of construction but a date around 1890 seems likely. In 1898, Mr. Robertson was in the process of extending his ditch and improving the intake from the river near point D (Figure 2). To provide a continuous supply of water for residents along the Little Bow River,

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[6] Refer to Appendix C and letters dated 29 September, 12 October and 17 November, 1898.

[7] Appendix C; see letter dated 29 September 1898 (Page 1, Para. 2); also letter of 12 October 1898 (Page 1, Para. 2).

the Government of the North-west Territories undertook to divert up to 1.4 m^3/s of Highwood River water into this basin, via the Robertson ditch, on a 12-month basis. They essentially took over responsibility for the initial 500 m of this ditch, constructed headworks (Photo 1), enlarged the ditch to accommodate up to 2.8 m^3/s and constructed a dividing structure within the Town[8]. This latter structure was for the purpose of separating Mr. Robertson's water from that being diverted into the nearby Little Bow River channel. There is no evidence to suggest that a natural overflow to the Little Bow River existed along the ditch route prior to its construction by Mr. Robertson. Rather, the ditch had to be excavated through a relatively high river bank.

2.2.2 Developments Between 1904 and Present

By 1904 a cutoff channel had developed through the "island" - see Figure 2. It is not clear whether this cutoff was natural or man-assisted. The upstream end of the cutoff was in the vicinity of the diversion headworks and as a result, the South Channel became abandoned and the headworks came under direct attack from the river. As well, it became increasingly difficult to divert flows during low flow periods, probably because the river bed was degrading in response to the cutoff. Considerable effort was required in the following years to repair ongoing erosion damage to the diversion system.

In 1905 and 1906 a timber crib wall system was constructed near the diversion headworks in order to raise minimum water levels, so that adequate amounts of water could be diverted at all times (Photos 2 and 3). The configuration of this system was such that it confined flows coming out of Baker Creek and directed them into the diversion ditch. The timber wall also acted to protect the diversion headworks.

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[8] Appendix C; see letter dated 12 September 1898 (Page 2, Para 2).

A 1906 report[9] makes the following relevant observations:

(1) Large springs were observed feeding into the upper end of Baker Creek in the vicinity of A and B (Figure 2). January flow from both springs totalled an estimated 0.1 m^3/s. A recently active flood channel was noted in the vicinity of A.

(2) Several other springs were noted along Baker Creek. It was estimated that "at the mouth Baker Creek probably carries from 12 to 15 ft^3/s (0.34 to 0.42 m^3/s) at lowest stage".

(3) A flood channel connecting the river and Baker Creek was observed at C (Figure 2). A concern was expressed that the river had the potential of breaking through permanently into Baker Creek along this flood channel.

In subsequent years there were frequent flood damage related maintenance problems with the diversion system at the mouth of Baker Creek. As well, Baker Creek too often did not carry sufficient water to meet demand along the Little Bow River. A headworks was constructed at C (see Photo 4) to augment flow in Baker Creek by diversion from the Highwood River - the exact year of construction is not known, but was likely during the period 1906-16. The meander loop at C was obviously active during this period, but since then the main channel has shifted to the valley's north edge.

By 1917 Baker Creek was receiving increasing amounts of flood flow, and a threat was perceived that the main channel of the Highwood River could break through into the creek in the vicinity of A and B (Figure 2) and ultimately into the Little Bow River watershed near High River town. The response in 1917 was to construct a dike and erosion

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[9] "Report on traverse of Highwood River and tributaries, upstream and near to Town of High River"; R.W. MacIntyre, Public Works, Government of the N.W.T., 10 February 1906 (copy provided in Appendix C of this report).

protection at the head of Baker Creek. This dike is now known as the Hoeh Dike (Photos 5 and 6). Subsequent floods damaged this dike, which was lengthened and strengthened after each such event. In 1952 the dike was extended upstream to its current position, and in 1966 the erosion protection was upgraded.

One apparent impact of the Hoeh Dike was to severely reduce the amount of base flow in Baker Creek, which in turn would have reduced the quantity of water available for diversion into the Little Bow River through the headworks at the downstream end of Baker Creek. This led to action in 1919 to improve the diversion system at C, for a short time enabling greater amounts of Highwood River water to enter Baker Creek.

By 1923 it became apparent that the Little Bow River diversion headworks at High River and at C were uneconomic and impracticable to maintain, so steps were taken to construct a new diversion works and ditch at a location on the south bank immediately downstream of the Highway 2A bridge. This system is still functioning today. At the same time, steps were taken to fill in the head of the old diversion ditch at D, and the Baker Creek diversion works at C.

In 1933 a new diversion works and channel were completed and began operation 2 km upstream of the Hoeh Dike for the purpose of conveying Highwood River water into the Little Bow River via Squaw Coulee and Mosquito Creek. The licensed capacity of this diversion system was 0.7 m^3/s. When the system was rehabilitated in 1979, the diversion capacity was increased to 1.7 m^3/s.

Sometime prior to 1942 a gravel dike had been constructed by the Town along the south bank of the Highwood River - in Figure 2, this is labelled as the Town Dike. This dike was not effective during the 1942 flood and so by 1947 it had been lengthened and raised. It now extends from the mouth of Baker Creek to the rail bridge. The height of dike is not sufficient to contain the 100-year flood peak but still effectively isolates the old Highwood River channel that was active in 1898 (South Channel).

2.2.3 Frequency and Magnitude of Inter-basin Overflows

Natural overflow of Highwood River water into the Little Bow River watershed near High River town is known to have occurred on at least 4 occasions[10] since 1880, or once every 22 years on average. The circumstances in each case involved major flow in Baker Creek and overflow eastward out of this creek along a 1 km front lying immediately southwest of High River town (Figure 2). There was one reported overflow southward at the rail bridge on the Highwood River, but we believe the amount would have been minor in comparison to the overflow occurring concurrently out of Baker Creek. Taking into account the 4 occurrences of observed interbasin flow this century, and adjusting upwards the recorded instantaneous floods peaks at the downstream Aldersyde gauge to account for overflow out of Baker Creek,[11] it appears that the lowest upstream peak at which interbasin flow occurred was 775 m^3/s. The highest flood peak during which interbasin flow was not reported was 520 m^3/s in 1953. Thus, it would appear that the beginning of interbasin flow commences at Highwood River discharges between 520 and 775 m^3/s (upstream of High River) which have return periods of about 25 and 60 years, respectively.

2.3 Highwood River Morphology

The river cross sections in Appendix A provide a description of the Highwood River morphology from the Hoeh Dike to High River town as surveyed in 1974. An inspection of these cross sections reveals the following:

(1) Baker Creek, at Cross-sections 5 thru 9 (see Figure 2 for section locations), is located at or near the right edge of floodplain and the south valley margin.

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[10] Overflow occurred in 1923, 1929, 1932 and 1942.

[11] For overflow events, flood peaks at Aldersyde were adjusted upwards on the basis of Figure 4 (to account for spill into the Little Bow River) in order to estimate the flood peak upstream of High River.

The Baker Creek channel and associated nearby subchannels are similar in size to those along the present-day Highwood River main channel. This indicates that during some period in the past a major portion of the Highwood River flowed down what is now Baker Creek.

(2) Within the reach bounded by Cross-sections 5 and 9 there is high ground between Baker Creek and the main channel. Once water enters Baker Creek in the vicinity of A and B (Figure 2) it is essentially contained along this creek at least as far as Cross-section 9.

(3) At Cross-section 10 the conveyance along Baker Creek is reduced substantially. For example, at the 900 m^3/s flood level, the conveyance[12] along Baker Creek is approximately 85 percent lower at Cross-section 10 than at Cross-section 9. As the greater part of natural diversion into the Little Bow River watershed occurs in this area[13] the apparent reduction in carrying capacity downstream of Cross-section 9 suggests that much of the flood flows carried by Baker Creek have been diverted eastward out of the Highwood River floodplain.

2.4 Conditions for Inter-basin Flow

2.4.1 Conditions 100 Years Ago

Water surface profiles were computed using the set of cross sections presented in Appendix A. The cross sections were first adjusted to correspond more closely to morphological conditions of 100 or so years ago. For example, the Hoeh and Town dikes

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[12] Conveyance (K) = $AR^{2/3} / n$.

[13] See Section 2.4.1.

were deleted from the respective cross sections. Water surface profile computations were carried out for discharges ranging from 250 to 1000 m^3/s, using the HEC-2 computer program.[14]

Computed water levels were used to estimate circumstances and locations at which Highwood River/Baker Creek water might cross over the watershed divide into the Little Bow River watershed. This assessment was aided by an NHCL ground inspection and by recently completed 0.5 m interval contour mapping provided by Alberta Environment.

The area of potential overflow begins at about Cross-section 8. Upstream of this is the south valley wall, while along Baker Creek it was determined that overflow would occur downstream of Cross-section 11 only during severe floods - say a 50-year flood peak (730 m^3/s) and higher. Therefore, the overflow assessment concentrated on the part of the divide between Cross-sections 8 and 11.

Figure 3 provides plotted water surface profiles between Cross-sections 8 and 11, for discharges from 250 to 1000 m^3/s. Based on a comparison of these profiles with the ground contours and field observations, the primary outflow areas shown in Figure 2 (Points 2, 3 and 4) were identified. At sufficiently high discharges (Figure 4), Highwood River/Baker Creek water flowing through these areas ultimately crosses into the Little Bow River watershed (Photo 8). Point 1 is the first location of overflow out of Baker Creek, but overflow into the Little Bow River watershed first occurs in the vicinity of Point 4. Overflow conditions in terms of elevation and Highwood River discharge/return period are as follows:

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[14] "HEC-2 Water Surface Profiles"; Corps of Engineers, 1991.

Estimated Overflow Conditions to Baker Creek 100 Years Ago

Point	Overflow Ground Elevation (m)	Highwood River Discharge[15] (m^3/s)	Return Period (years)	Comments
1	1049.7	200	4	Baker Creek overflows[16]; no interbasin overflow
2	1048.0	550	30	Interbasin flow
3	1047.1	450	18	Interbasin flow
4	1044.7	400	15	Interbasin flow

These values, which represent conditions as they were 100 years ago, suggest that overflow into the Little Bow River watershed occurred on average once every 15 or so years. Baker Creek, downstream of Cross-section 8, overflowed its right bank on average once every 4 or so years.

2.4.2 Conditions Today

With conditions as they are today, there are some apparent differences. Discussion in Section 2.2 indicated that interbasin flow did not occur at a discharge of 520 m^3/s in 1953, yet the water surface profile analysis suggests it should begin occurring at some lower discharge. Allowing for some inaccuracies in the analysis, the difference can in our opinion be attributed to the following:

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[15] Above town of High River.

[16] Indicates occurrence of overflow of south bank of Baker Creek but not necessarily interbasin flow into Little Bow River. Water would not manage to cross over divide until Highwood River discharge reaches 400 m^3/s (Point 4).

(1) The north-south county road embankment along Cross-section 11 (Photo 9), south of 12th Avenue, is sufficiently high to pond water and redirect it northward back into Baker Creek in the vicinity of 12th Avenue. Referring to the plot for this cross- section in Appendix A, the top of road and the west ditch profiles indicate that the ditch could carry water northward.

(2) At some time in the past, a small dike was constructed at Point 4 (Photo 10). This lends credence to the above view that this is the first point of overflow. The impact of this dike would be to somewhat reduce the frequency of overflow to that of Point 3.

(3) Baker Creek has not overflowed its right bank downstream of Cross-section 8 at anything like the frequency suggested above for Point 1. This is attributed primarily to the fact that Baker Creek has received a diminished amount of flow in recent times, due primarily to the presence of the Hoeh Dike and to a general northward shifting of the Highwood River main channel downstream of Hoeh Dike. This shifting has probably made it more difficult for flows to reach Baker Creek in the same quantities, particularly via C (Figure 2), where overflow into Baker Creek was reported to be quite frequent 85 years ago.

2.4.3 Effect of Historical Developments on Overflow Frequency

We conclude from the above discussion that:

(1) Before the historical developments, that is, about 100 years ago, interbasin flow occurred, on average once every 15 years or so.

(2) Under present conditions (see Figure 4) with dikes and roads in place, interbasin flow will occur on average once every 25 to 30 years or so.

3. RESPONSE TO SPECIFIC CONCERNS AND QUERIES

The following sections, 3.1 to 3.6, generally address the points and questions listed in Section 1.2.

3.1 Understanding of Highwood River to Little Bow River Interbasin Flow Process During the Last 100 or so Years

3.1.1 Flood Overflows

Before establishment of High River town and before any influence from dikes and roads, overflow out of Baker Creek into the Little Bow River watershed first occurred at Point 4 (Figure 2). The estimated frequency of this occurrence was once every 15 or so years, on average. With increasing discharge, overflow occurred at Point 3 (once every 20 years) and then at Point 2 (once every 30 years). Overflow at other locations along the watershed divide occurred at rarer intervals.

Baker Creek, the 5.6 km long channel that conveys water to the overflow area, is a historic Highwood River channel that became isolated as the river shifted northward. A century ago there was a continuous base flow supplied by the Highwood River via springs, but the Highwood River did on occasion overflow directly into Baker Creek, primarily through areas A, B and C (Figure 2). Today, Baker Creek appears to have almost no base flow, due largely to the presence of the Hoeh Dike constructed in 1917 and to a general northward shift of the Highwood River away from Baker Creek downstream of this dike. The Hoeh Dike would not be overtopped by a 100-year flood peak and should the armour adequately serve to protect the dike, it appears that the primary diversion of Highwood River water into Baker Creek today occurs through Area C.

Today, it can be expected that Highwood River/Baker Creek overflow into the Little Bow River watershed will occur, on average, once every 25 to 30 years. This is somewhat less frequent than 100 years ago. The primary reasons for the change are considered to be: (i) the county road embankment south of 12th Avenue along Cross-section 11; (ii) a dike constructed at Point 4 (Figure 2); (iii) the Hoeh Dike and (iv) a general shift of the Highwood River main channel to the north edge of the floodplain.

3.1.2 Water Supply Diversions

Man-made diversions out of the Highwood River began around 1890 when a local rancher (Mr. Robertson) constructed an off-taking ditch in the vicinity of D (Figure 2). This ditch conveyed water through High River town for use in an area immediately northeast of the Town. In 1898 the Territorial government took over responsibility for operation of the Robertson Ditch headworks when they constructed a formal headworks structure on the south bank of the Highwood River at D, and enlarged the upstream 500 m of the ditch to accommodate a flow of 2.8 m^3/s. At the downstream end of this enlarged ditch, 1.4 m^3/s was to be diverted into the Little Bow River, with the remainder being diverted for use by Mr. Robertson. Records show that during the following 25 years considerable difficulties were experienced in maintaining the diversion, largely due to a Highwood River channel cutoff that developed soon after 1898 immediately downstream of the headworks. Subsequent to this cutoff, the Highwood River bed degraded below the headworks invert and the upstream channel was aligned such that it impinged directly onto the headworks. In order to direct Baker Creek flows into the Little Bow diversion ditch, to raise water levels at the headworks during low flow periods, and to protect the headworks from attack by the Highwood River, a timber crib wall was constructed in the early 1900's at the mouth of Baker Creek and works were constructed to isolate the area from direct attack from the Highwood River. Thus, by the early 1900's, diversion amounts were completely dependent on Baker Creek flows. This caused problems because Baker Creek did not always carry sufficient flow, particularly after construction of the Hoeh Dike in 1917. Efforts were

therefore made to divert Highwood River water into Baker Creek upstream, principally in the area of C (Figure 2). Generally, the Little Bow River diversion scheme did not perform up to expectations and too often, they were able to divert little or no water through the ditch. For the period 1910-23, a maximum diversion rate of 9.3 m^3/s was achieved (1915), but during most years there were periods of zero diversion. The average recorded rate was 0.4 m^3/s.

Because of these difficulties in operating the Little Bow River diversion headworks, it was relocated in 1923 to the south bank immediately downstream of the Highway 2A bridge, where it remains to the present day. Since 1923, the maximum recorded diversion rate was 19.8 m^3/s (1929). Average diversion rate has been 0.75 m^3/s.

In 1933 the Provincial government constructed the Squaw Coulee Diversion works to help alleviate water shortages of farmers and ranchers along Mosquito Creek - located 2 km upstream of the Hoeh Dike. The scheme was designed to divert up to 0.7 m^3/s. It appears that this was ultimately increased to 1.7 m^3/s during the 1970's after it was decided to rehabilitate and upgrade the system. These works have no significant impact on behaviour of the Highwood River at and downstream of the Hoeh Dike.

3.2 Effects of Human Activities on the Interbasin Flow Process

As discussed in Section 3.1, physical changes due to human activities have had some impact on the overflow process.

The Hoeh Dike has always failed during the higher flood events since it was first constructed in 1917 - the last major flood being in 1943. Therefore, the amount of flow carried by Baker Creek during flood events that resulted in major overflow to the Little Bow River has likely not been affected much by the Hoeh Dike, nor for that matter by any road system constructed on the floodplain between Baker Creek and the Highwood River.

However, we consider that the Hoeh Dike has had a significant effect on the flow regime in Baker Creek, primarily for Highwood River flood peaks up to about the 30-year return period. For flows up to this level the Hoeh Dike has had the effect of directing the Highwood River main channel northwards. This action seems to have set up a general northward shift of the river all the way to High River town, so moving the main flow path away from Baker Creek.

If the Hoeh Dike is secured up to at least the 100-year flood, the overflow potential of Baker Creek may be affected. The small dike along Cross-section 6, together with the natural high ground between the river and Baker Creek, will have made it more difficult for Baker Creek to receive Highwood River overflow upstream of Cross-section 7. Any significant overflow would likely have to occur along the historic overflow path at C. It is estimated that overflow to Baker Creek at C would begin at a Highwood River discharge in the order of 400 m^3/s, corresponding to a return period of about 18 years. This discharge is of the same order as that which causes Baker Creek to overflow into the Little Bow River. It might therefore appear that at the higher floods at least, the Hoeh Dike should have little impact on the interbasin overflow potential out of Baker Creek. However, we suspect that because of the increased distance of main channel flow from Baker Creek along a path to C, the ability for Highwood River flow to reach Baker Creek has become more difficult. The floodplain area between the main channel and C is currently composed of overgrown subchannels and man-made fills. The area can be defined as having poor conveyance characteristics. During a typical Highwood river flood, which has a duration of only a day or so, the ability to 'deliver' water to Baker Creek through this area must be diminished from what it was 100 years ago. This factor would likely act to generally reduce the frequency of interbasin flow.

Overflow derived from Points 2, 3 and 4 is intercepted by the north-south county road south of 12th Avenue, along Cross-section 11 (Figure 2). Because of the relatively steep ground slope eastward away from Baker Creek, water ponding behind the road embankment will have no significant backwater effect at the Baker Creek overflow points prior to this

road being overtopped. However, during the initial period of overflow and during flood peaks in the order of once in 20 years, it is likely that the road will force some flow back into Baker Creek via the road ditch (see Figure A11). It is not possible to quantify how much would be returned before the road is overtopped, but as we suggested in Section 3.1, this road likely has the effect of reducing the frequency of overflow into the Little Bow River.

Ponding will also occur behind the C.P.R. grade south of High River, as it has historically. It appears that this grade has been recently raised through Town, while some of the culverts through the railway embankment that existed in 1974 have since been closed off. These changes may result in higher flood levels in Town, but we do not consider that this would have a significant impact on the quantity of water ultimately reaching the Little Bow River. As well, most of the historic shallow channels that once carried water into the Town have been filled in and 12th Avenue appears to have been raised. These actions will serve only to maintain Baker Creek overflow to the area south of Town.

3.3 Rationale and Performance of the Hoeh Dike

In 1906 Baker Creek was referred to as Spring Creek, likely because it received most of its baseflow from springs along its 5.6 km length. Occasional direct overflow from the Highwood River occurred in the vicinity of A and C (Figure 2). It cannot be said for certain what the frequency of overflow was, but once every 5 years on average, seems a reasonable estimate.

It is apparent from the records that by 1917 an increasing amount of flow was entering the upstream end of Baker Creek, which raised a concern that all of the Highwood River would soon divert down Baker Creek and ultimately into the Little Bow River. We cannot be certain why this was happening, but fairly high flood peaks occurred in 1912, 1915

and 1916. These, in combination with possible land clearing in the vicinity of A and B, may have promoted entrenchment of Baker Creek at its upstream end.

In response to these concerns, the downstream part of the Hoeh Dike plus erosion protection were constructed along A and B during the fall of 1917. The purpose of this action was to prevent a complete shift of the Highwood River into Baker Creek. Major floods in 1923, 1929, 1932 and 1942 resulted in this dike being either outflanked, over-topped or damaged, such that a large amount of Highwood River flow still was able to go down Baker Creek.

Recognizing the objective of the Hoeh Dike as being to prevent a total diversion of the Highwood River into Baker Creek, it can be said that the dike has adequately served its purpose. Even though it apparently did not prevent a large amount of flow from getting into Baker Creek during the above-mentioned flood events, it was likely effective because the floods are of such short duration - much of the flood had probably passed by the time the dike was breached or outflanked.

With the construction in 1952 and upgrading and strengthening in 1965-66 of the upstream segment of the Hoeh Dike, it can be said that it remains today at least as effective as it was during major floods prior to this time.

3.4 Potential Effects of Removing Hoeh Dike

Removal of the dike, in our opinion, would result in a high potential for a complete shift of the Highwood River into Baker Creek. The Baker Creek channel and the adjacent subchannels are already of a size similar to what exists along the present-day Highwood River. Rapid erosion of the willow and tree cover, together with degradation of the upstream end of Baker Creek, could result in capture of the Highwood River.

Without the Hoeh Dike, it is quite conceivable and perhaps probable that the Highwood River would now be located in the south-half of the floodplain downstream of the Hoeh Dike. Because of the ridge of higher land separating Baker Creek and the Highwood River, the shifted Highwood River would be generally confined within the south-half of the floodplain as far downstream as Cross-section 7, much as it has been confined to the north-half during the last 100 or so years. Downstream of Cross-section 8 the floodplain contains a large number of shallow channels, including Baker Creek. In our opinion, the number and sizes of these subchannels would not significantly change with shift of the Highwood River along present-day Baker Creek upstream of Cross section 8. In these circumstances, however, it is expected that the frequency of overflow into the Little Bow River would increase. Concurrently, flood levels along the west boundary of High River town would also increase.

3.5 Possibility of Complete or Partial River Diversion Without the Hoeh Dike

We believe there is a better than 50-50 chance that without the Hoeh Dike, the Highwood River or a significant portion of it would now be located along Baker Creek, at least to Cross-section 8. The question remains whether the Highwood River as a whole would have crossed the watershed divide southwest of High River town, so that it might at least be partially captured by the Little Bow River. The Baker Creek channel presently lies closest to the divide near Point 4 (Figure 2), where the divide is contiguous with the creek's right bank.

We consider it unlikely that a partial or complete capture of the Highwood River by the Little Bow River would have occurred this century, even if the Hoeh Dike had not been constructed. Circumstances will have existed in the past several thousand years where a substantial portion of the Highwood River flowed along what is now Baker Creek and there

is no evidence (channel entrenchment)[17] to suggest that a breakthrough into the Little Bow River was ever in the process of developing. The overflow process involves a spreading-out into a large number of subchannels and none of the physical man-made changes has significantly altered this process. A more likely scenario would have seen the Highwood River shift back northward in the vicinity of Cross-section 8, towards its present-day location.

3.6 Reasons for Little Bow Diversion Canal

The first Little Bow River diversion works were constructed in 1898 in an attempt to satisfy a continuous year-round demand for water along the Little Bow River. This development occurred 19 years before construction of the Hoeh Dike. It was not constructed in response to a loss of natural diversion into the Little Bow River due to construction of the Hoeh Dike. However, several attempts were made to divert a greater amount of Highwood River water into Baker Creek when around 1904 the latter became the sole source of flow diversions into the Little Bow River. It was found that the natural flow in Baker Creek was not always capable of meeting diversion demands, even prior to 1917 when the Hoeh Dike was not present. The Little Bow River diversion ditch was relocated in 1923, primarily because it had become impracticable to maintain and operate.

3.7 Baker Creek Slope Greater Than Highwood River Slope

The statement has been made in the past[18] that because the slope along Baker Creek is steeper than along the Highwood River, the former would eventually capture the

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[17] Channel entrenchment is a process by which a channel erodes and downcuts into its surrounding terrain - the result is typically a gully having steep banks. The subchannels south of town are shallow and essentially non-eroding.

[18] "Highwood River Study", A.G. Underhill-Alberta Water Resources; 1964.

Highwood River, which in turn would lead to complete capture of the river by the Little Bow River.

The slope along Baker Creek is in fact greater by about 40 percent. This is attributed to its lesser length between the entrance and mouth of the creek as compared to the distance along the Highwood River. This factor would be one which encourages a shift of the Highwood River into Baker Creek. As we have indicated in Sections 3.4 and 3.5, without the Hoeh Dike there is a significant chance that this shift would have occurred this century. In our opinion, the higher slope would have eventually reduced to a lower (regime) one through a combination of bed degradation of Baker Creek at its upstream end and enhanced meandering along the creek. Subsequent capture of this channel by the Little Bow River, however, would have been unlikely.

4. SUMMARY AND CONCLUSIONS

4.1 Man-made diversion of Highwood River water into the Little Bow River began about 1890 with the construction of a small private diversion ditch. The point of diversion was at the northwest corner of High River town, near the mouth of Baker Creek. This ditch generally ran eastward through the town. In 1898, to satisfy water demands by ranchers and settlements along the Little Bow River, the Territorial government undertook to divert Highwood River water into the Little Bow River at High River town. The upstream 500 m of the Robertson ditch was enlarged and provided with headworks. This system served both Mr. Robertson and residents along the Little Bow River.

Subsequent difficulties with maintaining the headworks required construction of a small dam and erosion protection works. This system then depended entirely on water flowing in Baker Creek. Construction of the Hoeh Dike in 1917 exacerbated the problem of a shortage of natural flow in Baker Creek. Continued problems with the diversion headworks resulted in abandonment of the headworks and relocation to the right bank of the Highwood River immediately downstream of the Highway 2A bridge in High River town. This system remains functioning today.

4.2 Natural overflow into the Little Bow River watershed commences along Baker Creek, immediately southwest of High River town. Spillover points have been identified in Figure 2 as 2, 3 and 4. For conditions as they were 100 years ago, it is estimated that natural interbasin diversion commenced at a Highwood River flow of about 400 m^3/s (return period of 15 years). Today, it is our opinion that interbasin diversion commences at about 550 m^3/s (return period of 25 to 30 years). This change is attributed to the following factors: (i) construction of the Hoeh Dike; (ii) filling in of the old diversion ditch at C (Figure 2) in 1923 has closed off an old, natural overflow channel to Baker Creek; (iii) a shallow dike has been constructed at Point 4 (Figure 2) - this is the historic first point of overflow to the Little Bow River; (iv)

the north-south county road embankment south of 12th Avenue and immediately east of Point 4 causes water to pond, resulting in some flow being diverted northward back to Baker Creek along the west-side road ditch.

4.3 The Hoeh Dike was constructed in 1917 in response to a concern that the Highwood River was about to shift into Baker Creek and ultimately into the Little Bow River watershed. Although several large floods since then either washed away the dike, or went around or overtopped it; the religious efforts made to reconstruct and extend the dike after every damaging flood has likely served the purpose of maintaining the original objective of preventing the Highwood River from shifting into Baker Creek. Its condition today allows it to continue meeting this objective.

4.4 If the Hoeh Dike were removed, it is our opinion that there is a better than even chance that the Highwood River would eventually divert completely into Baker Creek; at least to about Cross-section 8 (Figure 2).

4.5 If the Hoeh Dike had not been in place during the present century, it is our opinion that a complete or even partial capture of the Highwood River by the Little Bow River basin would not have occurred. The interbasin flow process has been on-going for the past several thousand years, and there is no evidence that any of the diversion channels has attempted to downcut and become larger.

4.6 The first Little Bow River diversion works were constructed in 1898, prior to construction of the Hoeh Dike. It was constructed in response to water demands along the Little Bow River and not to any perceived loss of natural overflow due to dike construction upstream of High River town. After 1917, the Hoeh Dike merely made it more tenuous as to whether Baker Creek carried sufficient base flow to meet the diversion demands at the downstream headworks.

4.7 The average Baker Creek slope (entrance at Hoeh Dike to mouth of creek) is approximately 40 percent greater than along the Highwood River main channel. This factor would have encouraged a complete shift of the Highwood River into Baker Creek, and without the Hoeh Dike there is a significant chance that this would have in fact happened. However, this shift would not necessarily have led to a subsequent diversion of the Highwood River into the Little Bow basin. Rather, it is more likely that the higher slope along the Baker Creek route would have been reduced through a combination of bed degradation at the upstream end of Baker Creek and enhanced meandering along the creek.

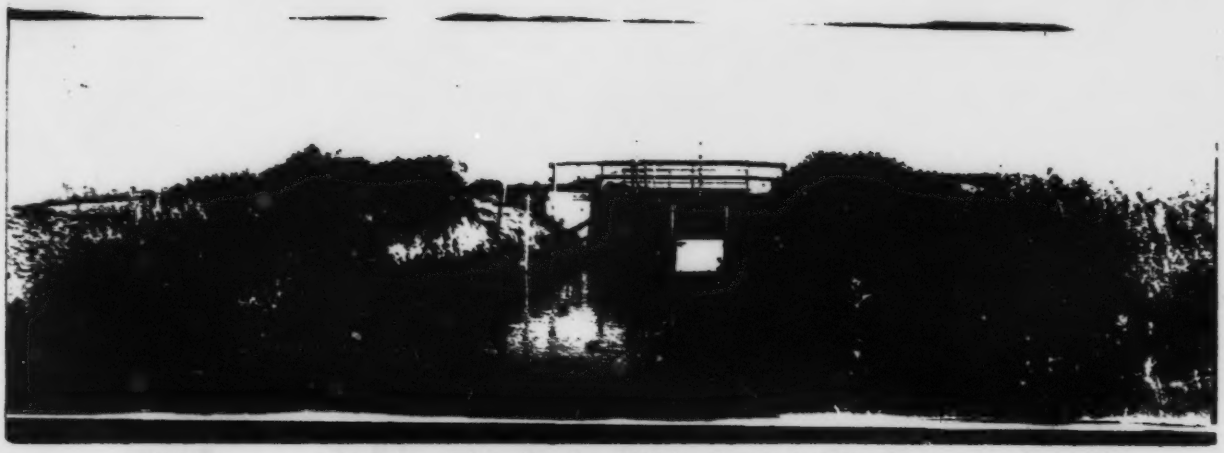


PHOTO 1. Little Bow River diversion ditch headworks in 1913. Photo taken from right bank of Highwood River at entrance to diversion ditch.

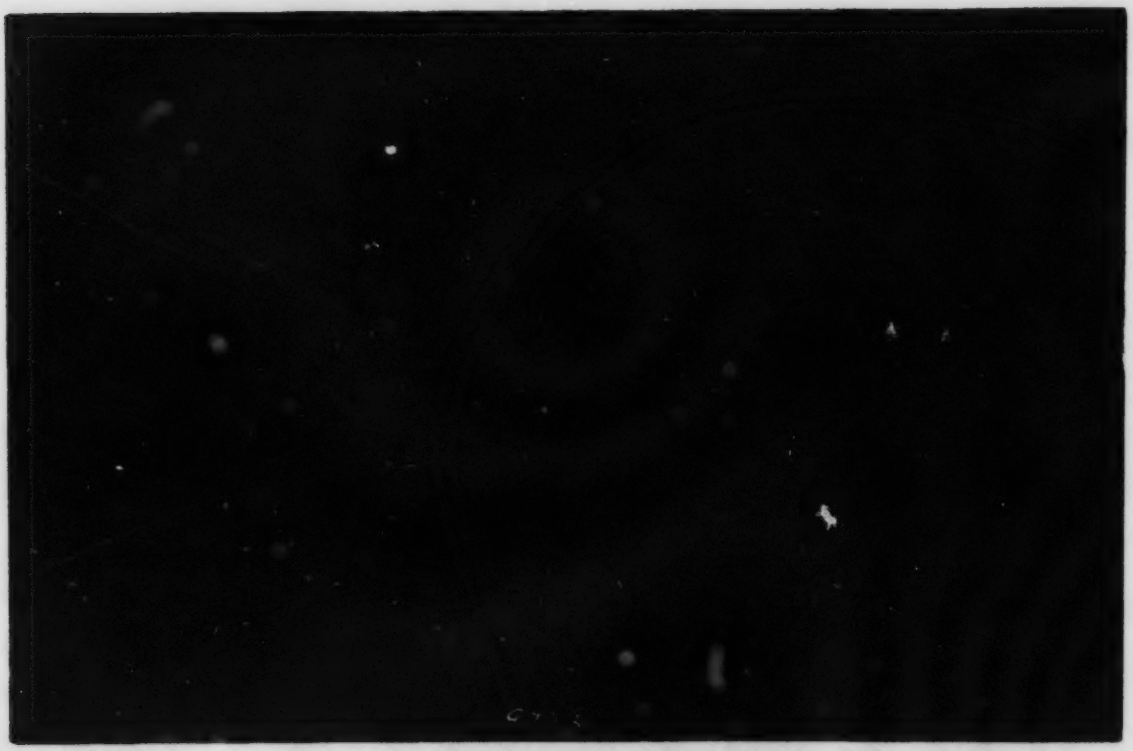


PHOTO 2. Timber crib wall used to pond and divert Baker Creek flow into Little Bow River diversion ditch. Entrance to ditch near left side of photo. Photo taken in 1916. Large opening in wall is result of flood damage.

PHOTO 3. Remains of timber crib wall shown in Photo 2. Entrance to diversion ditch was located at left edge of photo. Mouth of Baker Creek at right-centre of photo.

PHOTO 4. Headgate of diversion ditch from Highwood River, leading to Baker Creek in NE1/4 of 33-18-29-W4thM. Purpose of this ditch was to augment flow in Baker Creek. Photo taken in 1916.

PHOTO 5. Upstream end of Hoeh Dike. This part of dike constructed in 1952, with upgrading of erosion protection in 1966. Entrance to Baker Creek at right side of photo.

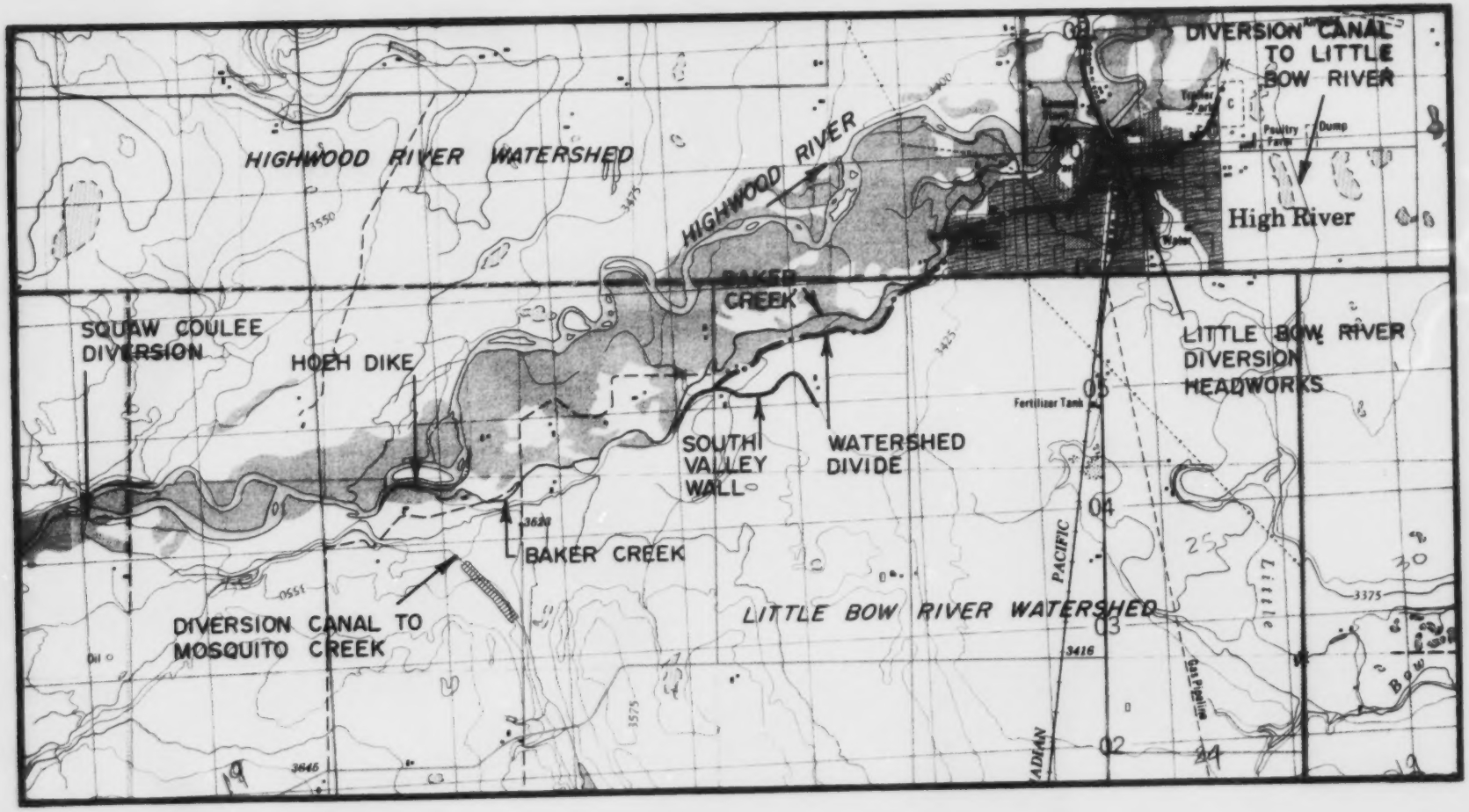
PHOTO 6. Viewing upstream to backside of Hoeh Dike and entrance to Baker Creek.

PHOTO 7. Dike constructed in 1928 in SW1/4 of 33-18-29-W4thM to prevent overflow into Baker Creek. Abandoned Highwood River main channel at left side of photo.

PHOTO 8. Viewing east towards Little Bow River watershed, from Baker Creek overflow area in NE1/4 of 34-18-29-W4thM.

PHOTO 9. Viewing east along swale leading to Little Bow River from Baker Creek. Small trees border a county road along east boundary of Section 34-18-29-W4thM. Photo taken from approximate location of Little Bow River watershed divide.

PHOTO 10. Viewing east to Little Bow River watershed, from Baker Creek overflow area in NE1/4 of 34-18-29-W4thM. Note small dike constructed across historic overflow area to Little Bow River.



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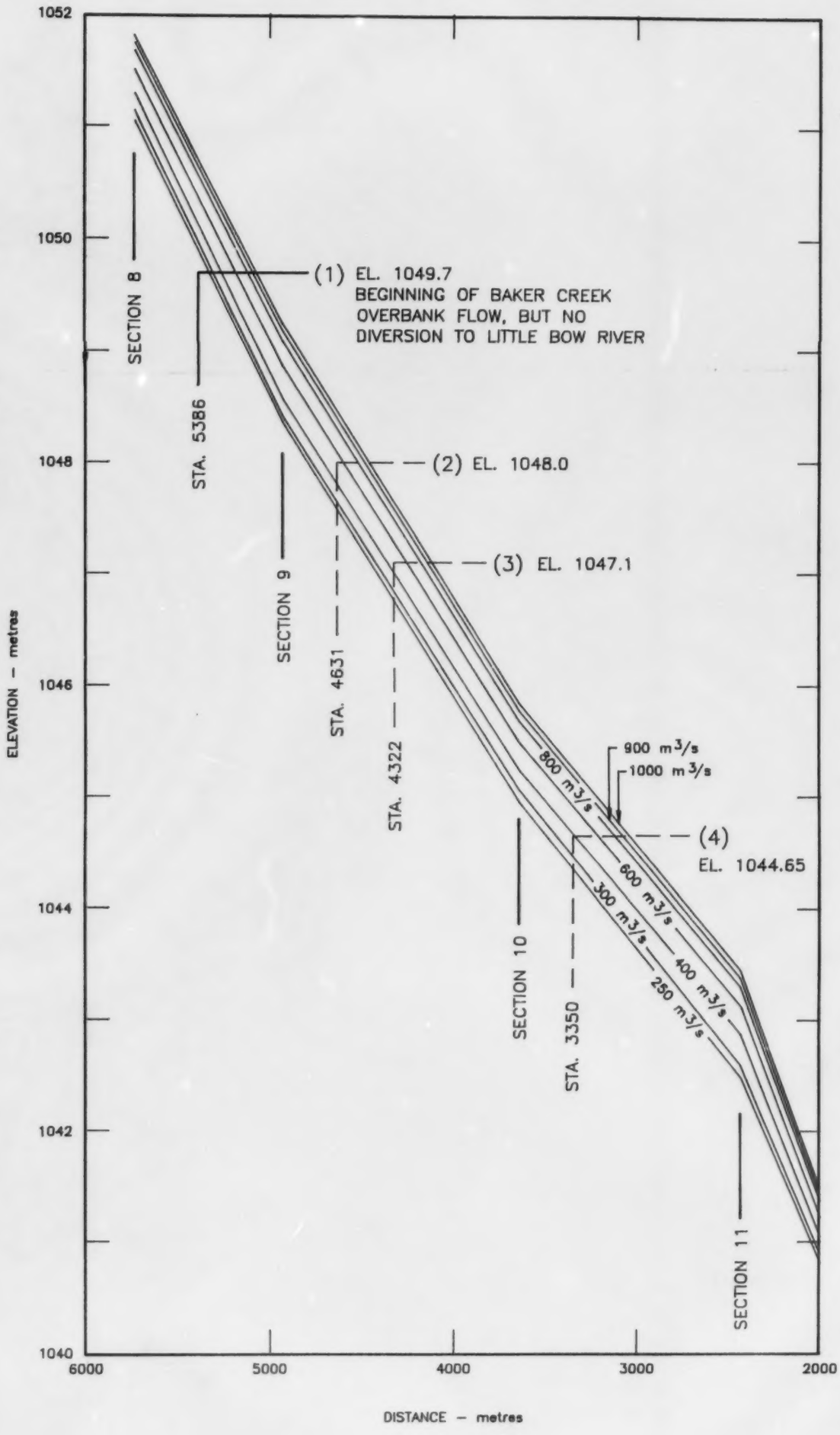
ALBERTA ENVIRONMENT		
HIGHWOOD / LITTLE BOW DIVERSIONS AT HIGH RIVER STUDY AREA		
Scale as shown	91-05-22	FIGURE 1
northwest hydraulic consultants ltd.		

NHCL 5392-006



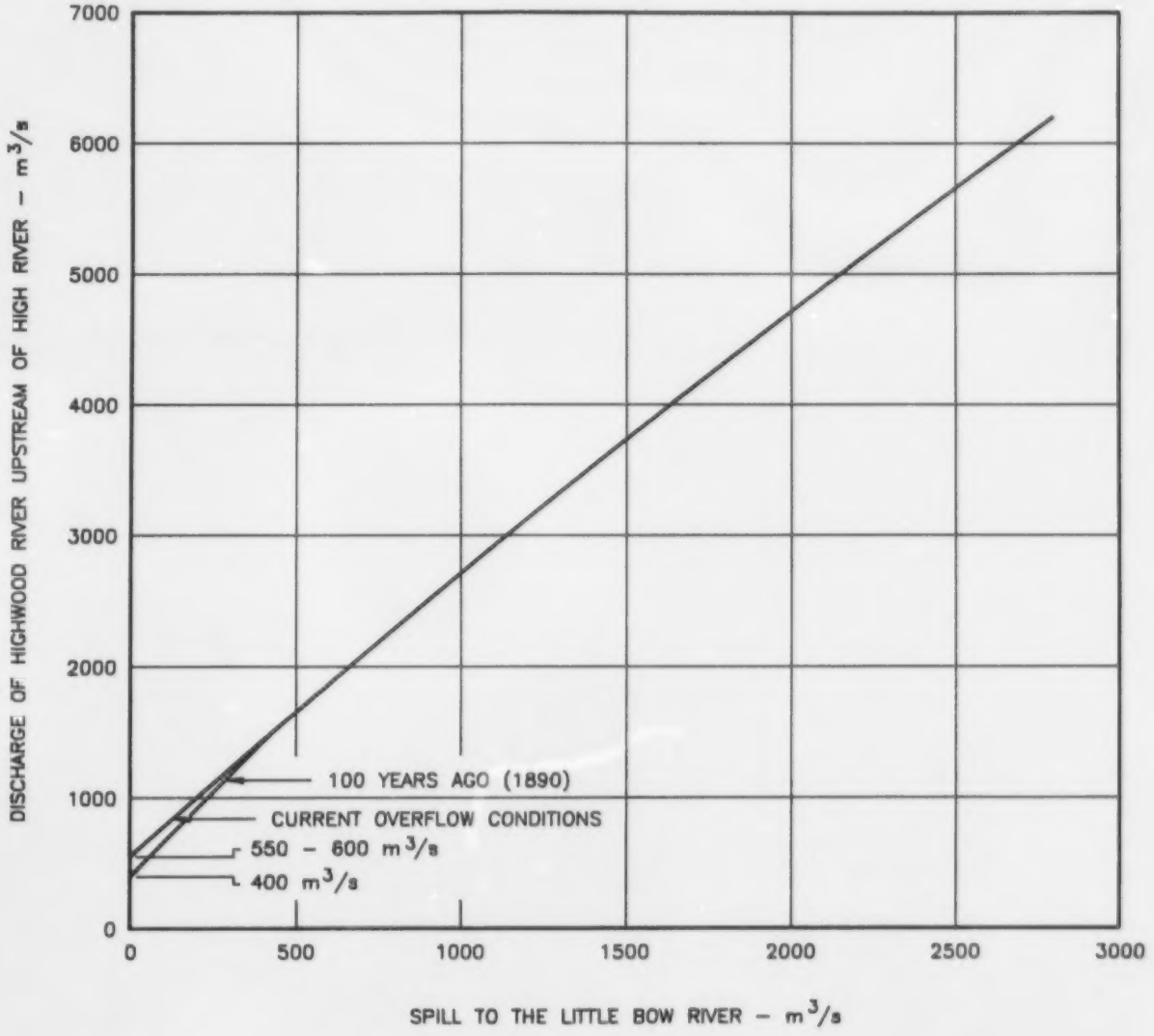
NOTES:

SEE FIGURE 2 FOR CROSS SECTION LOCATIONS AND BAKER CREEK OVERFLOW SITES.

STA. — — — EL. DISCHARGES IN HIGHWOOD RIVER AND CORRESPONDING ELEVATIONS AT WHICH BAKER CREEK OVERFLOWS RIGHT BANK TO LITTLE BOW DRAINAGE.

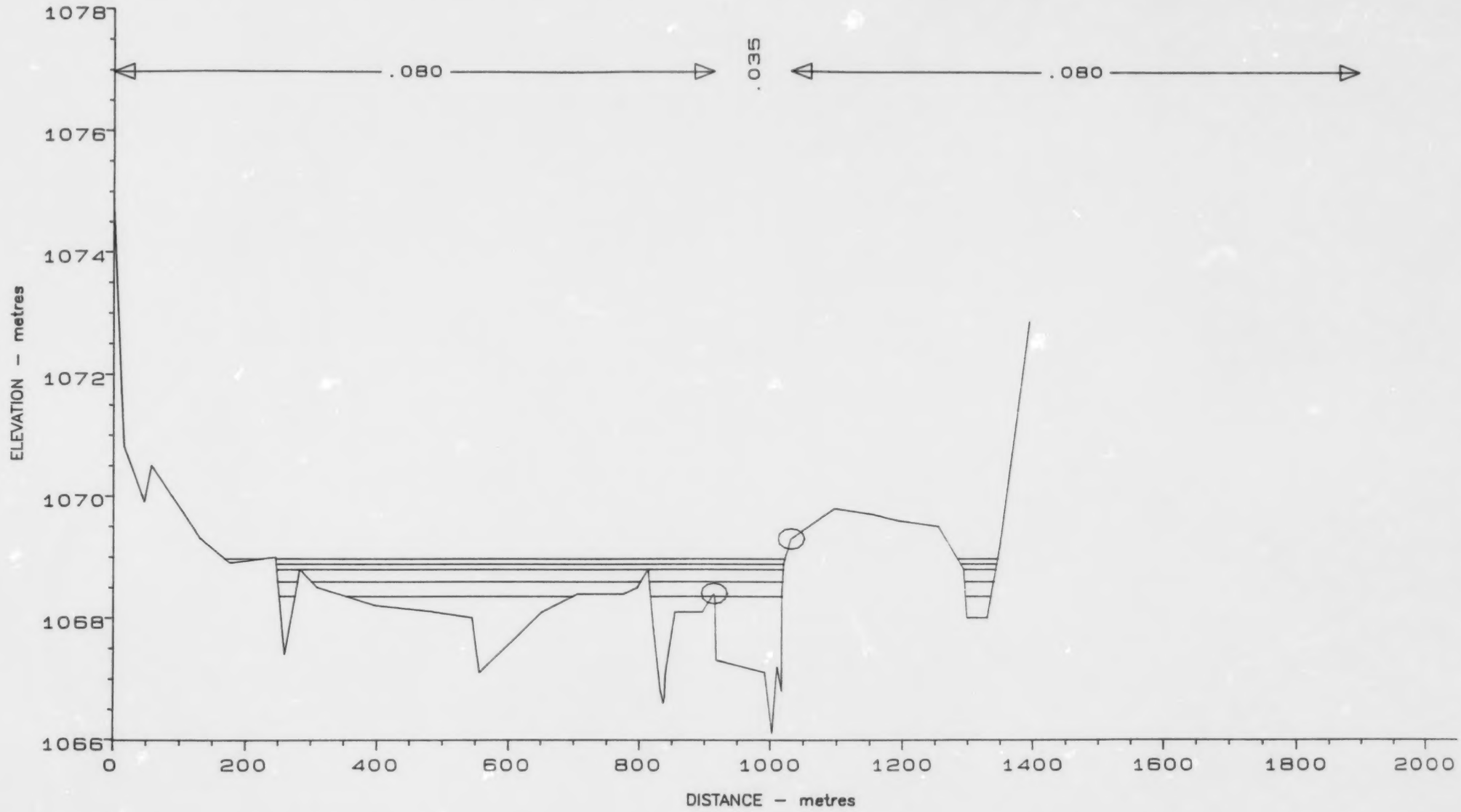
ALBERTA ENVIRONMENT		
WATER SURFACE PROFILES HIGHWOOD RIVER AT HIGH RIVER ESTIMATED 1898 CONDITIONS		
Scale as shown	91–05–23	FIGURE 3
northwest hydraulic consultants ltd.		

NHCL 5392–007



ALBERTA ENVIRONMENT		
HIGHWOOD RIVER FLOWS UPSTREAM OF HIGH RIVER VERSES SPILL TO LITTLE BOW RIVER		
Scale as shown	91–10–15	FIGURE 4
northwest hydraulic consultants ltd.		

NHCL 5392–008



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
SECTION SURVEYED BY NCHL IN 1974.

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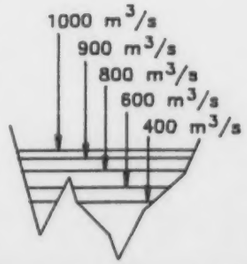


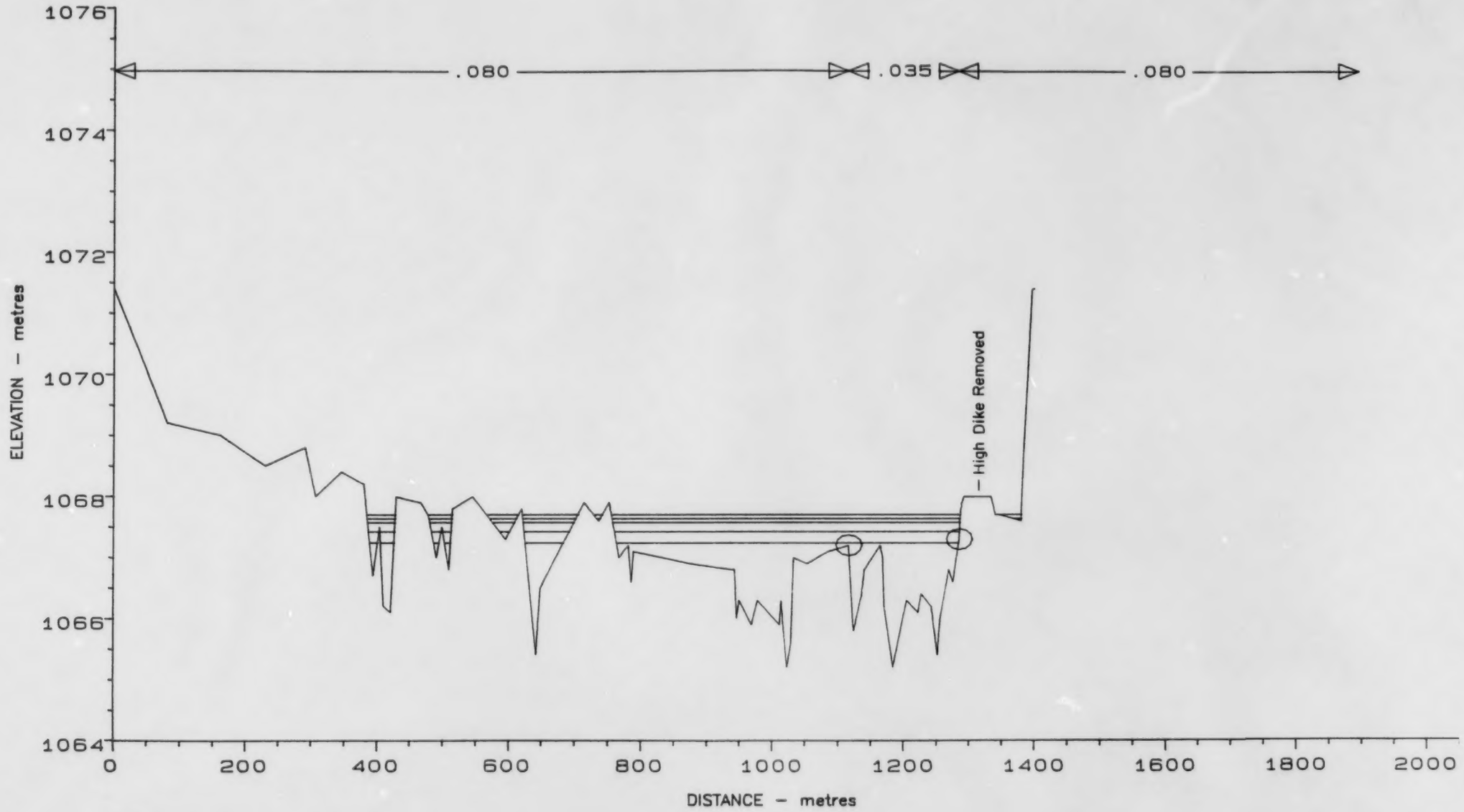
ALBERTA ENVIRONMENT

CROSS SECTION 1
HIGHWOOD RIVER NEAR HIGH RIVER

Scale as shown	91–05–27	FIGURE A.1

northwest hydraulic consultants ltd.

NHCL 5392–201



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
SECTION SURVEYED BY NCHL IN 1974.

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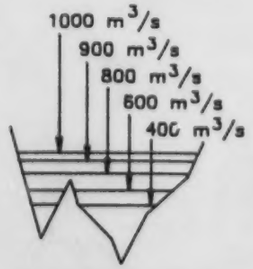
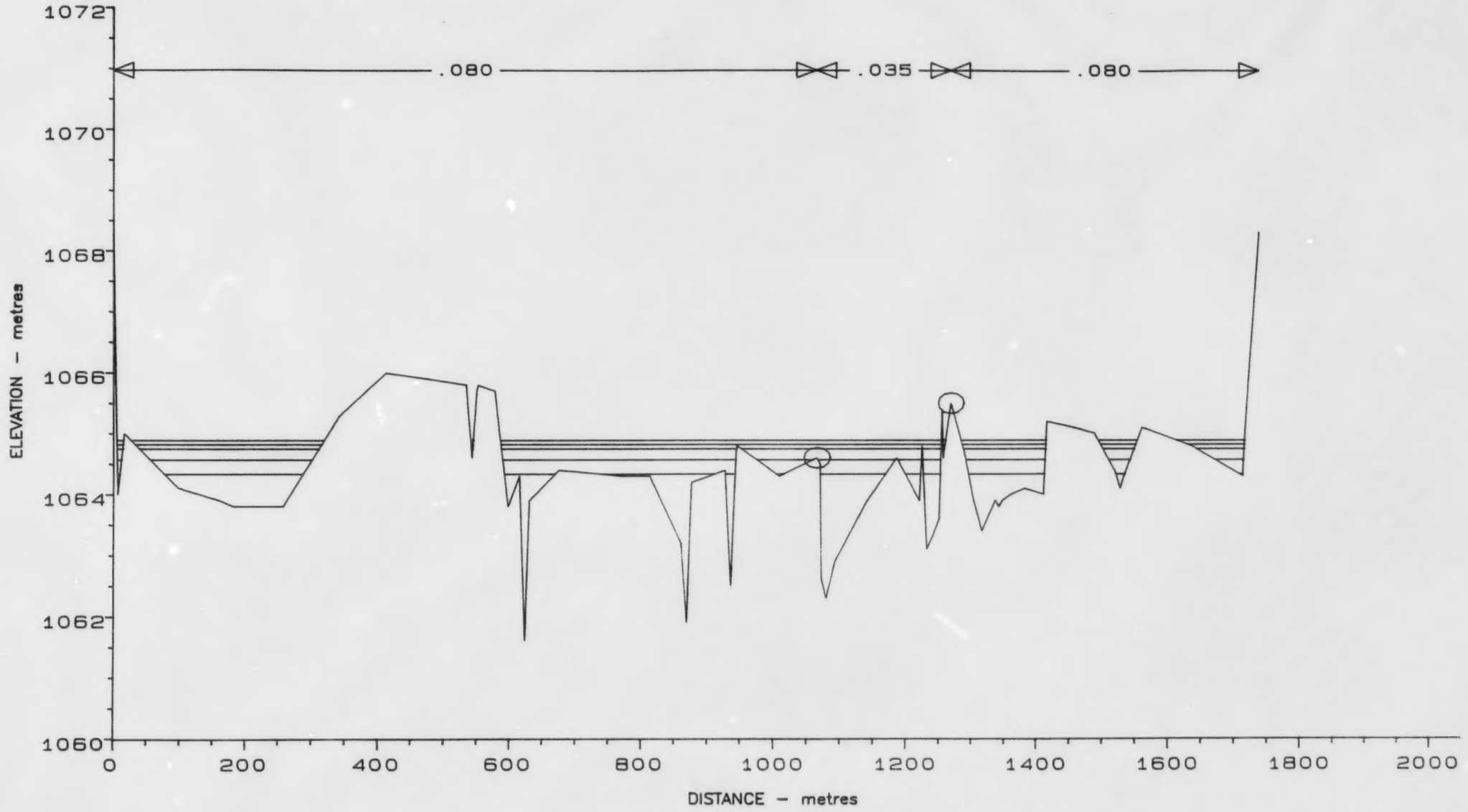


ALBERTA ENVIRONMENT		
CROSS SECTION 2 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91–05–27	FIGURE A.2
northwest hydraulic consultants ltd.		

NHCL 5392–202



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
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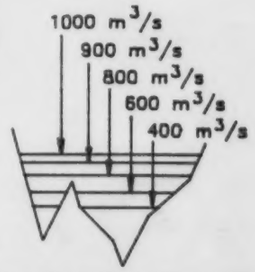
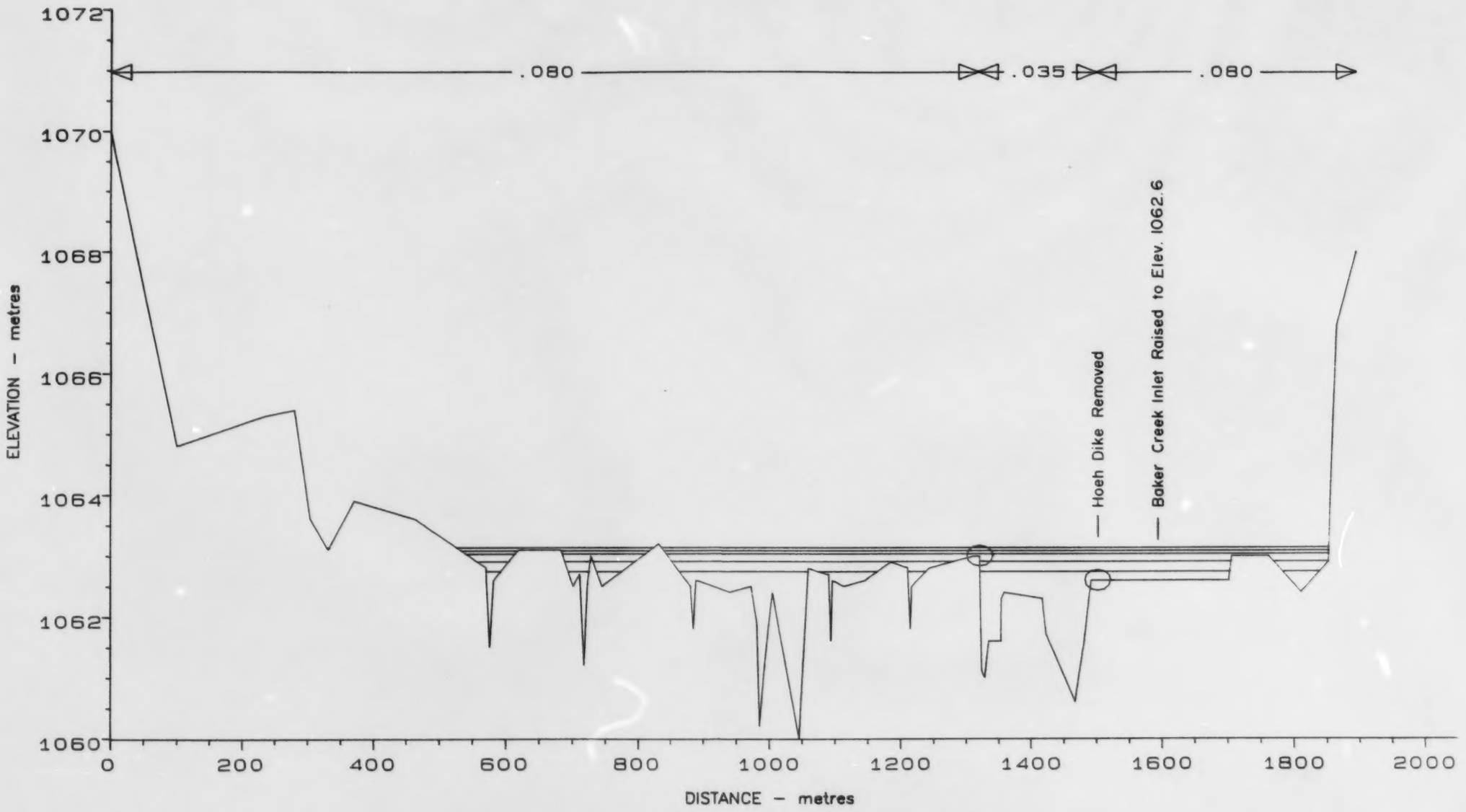


ALBERTA ENVIRONMENT		
CROSS SECTION 3 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91–05–27	FIGURE A.3
northwest hydraulic consultants ltd.		

NHCL 5392–203



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
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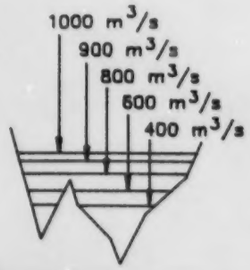

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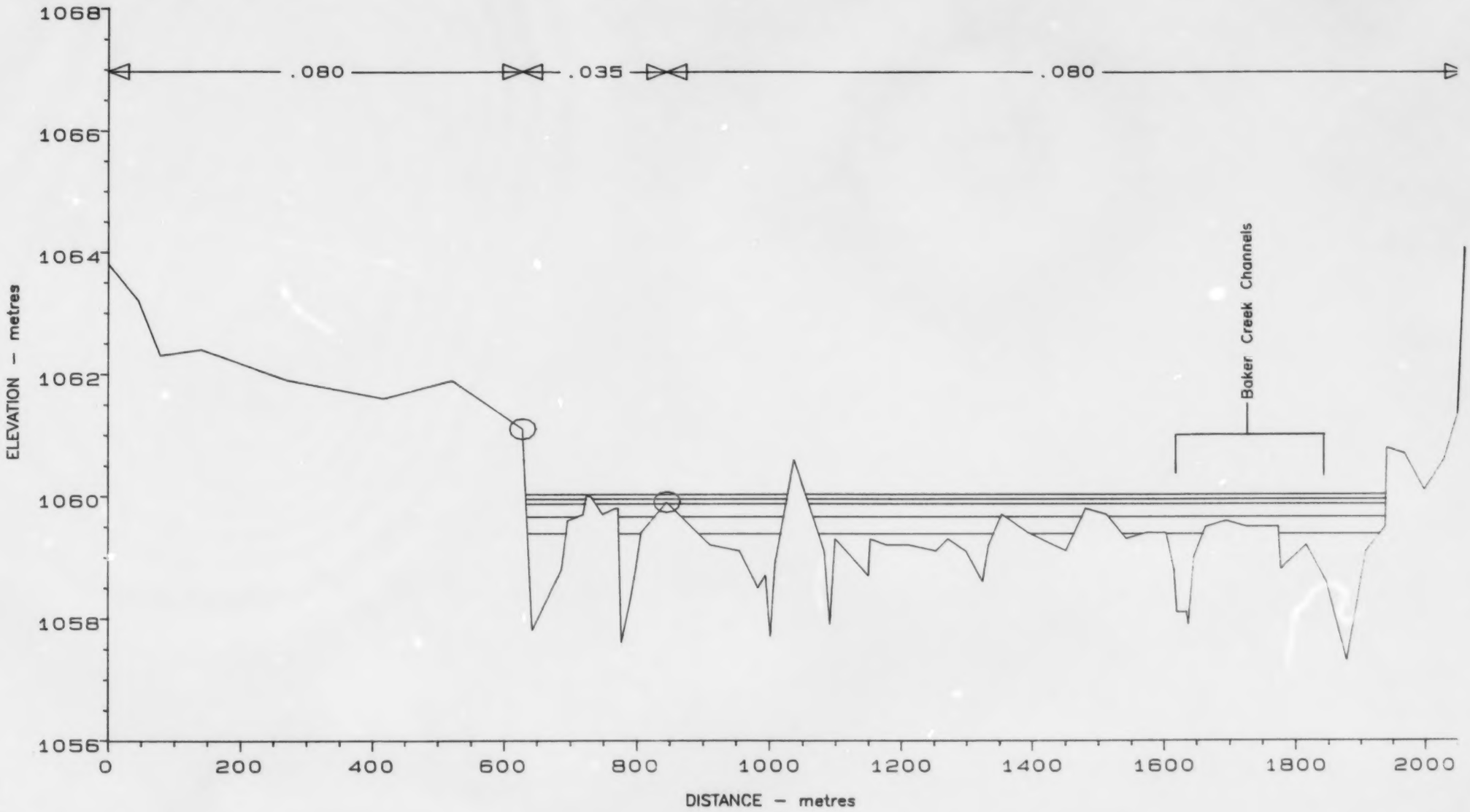
ALBERTA ENVIRONMENT		
CROSS SECTION 4 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91–05–27	FIGURE A.4
northwest hydraulic consultants ltd.		



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SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
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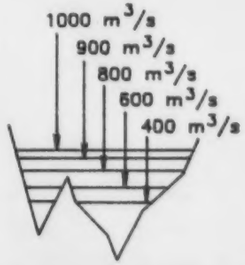
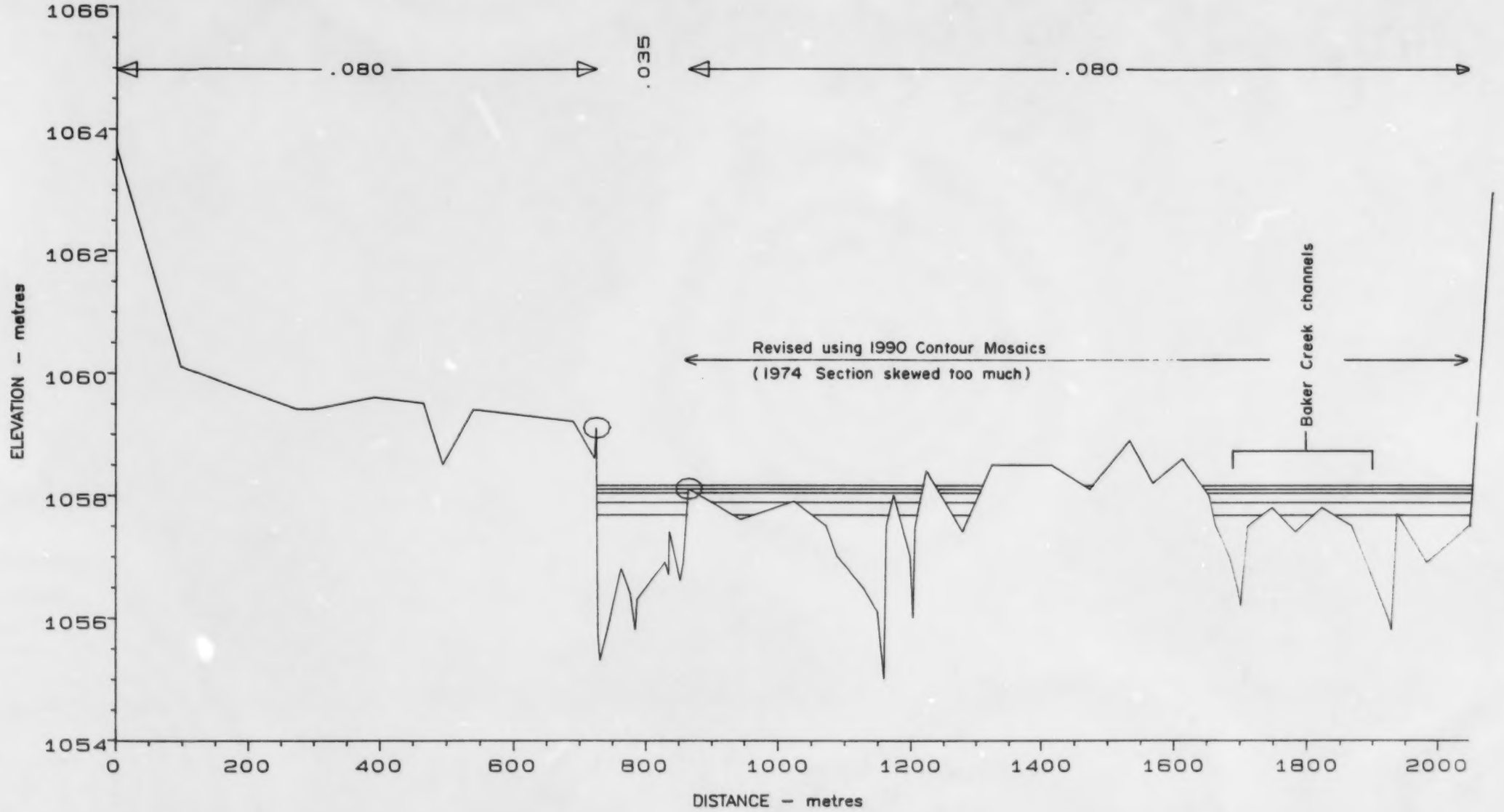


NHCL 5392–205

ALBERTA ENVIRONMENT		
CROSS SECTION 5 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91–05–27	FIGURE A.5
northwest hydraulic consultants ltd.		



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.

SECTION SHOWN VIEWING DOWNSTREAM.

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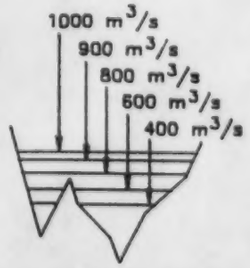
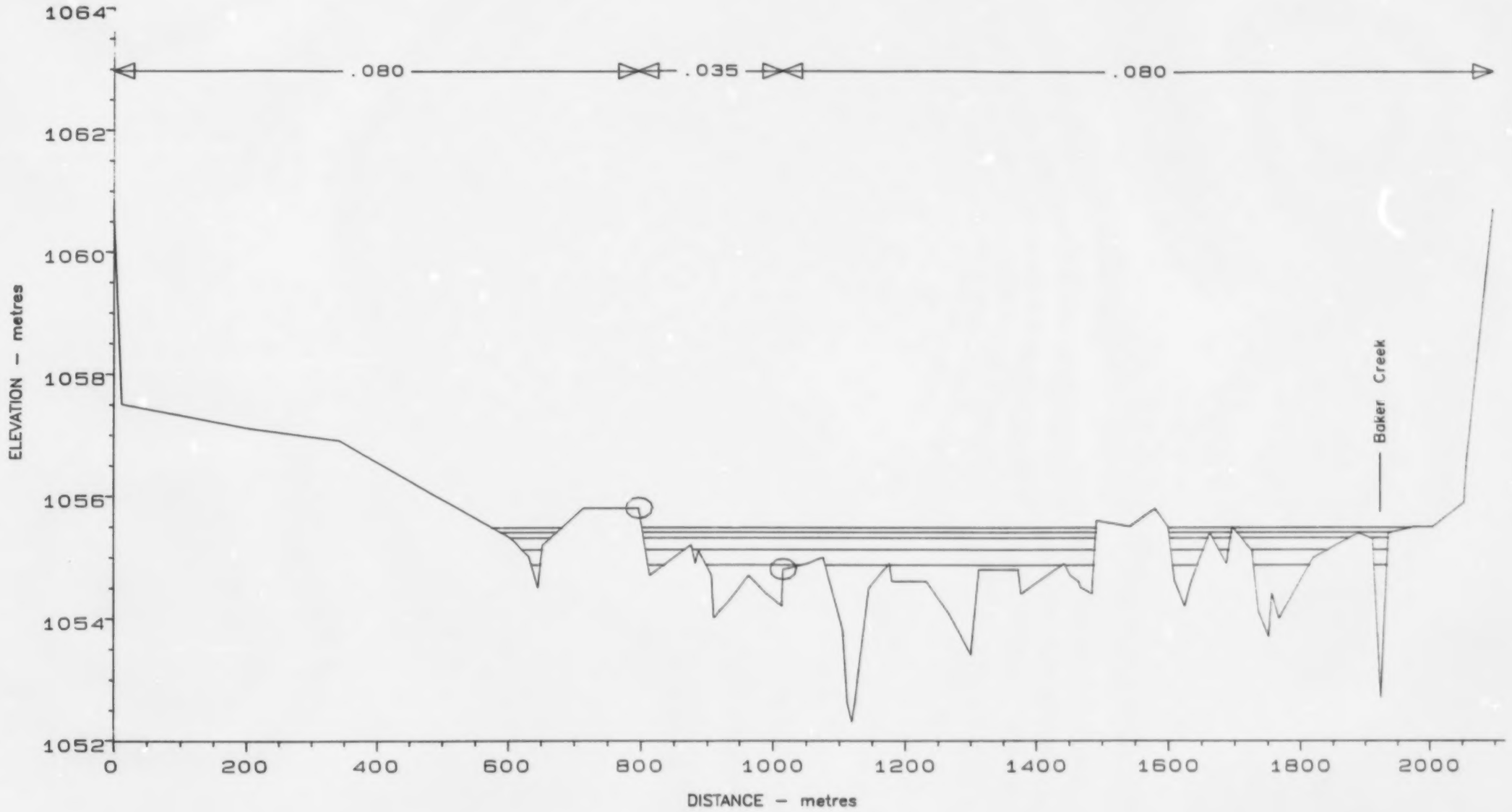


ALBERTA ENVIRONMENT		
CROSS SECTION 6 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91–05–27	FIGURE A.6
northwest hydraulic consultants ltd.		

NHCL 5392–206



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
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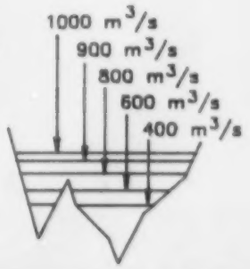


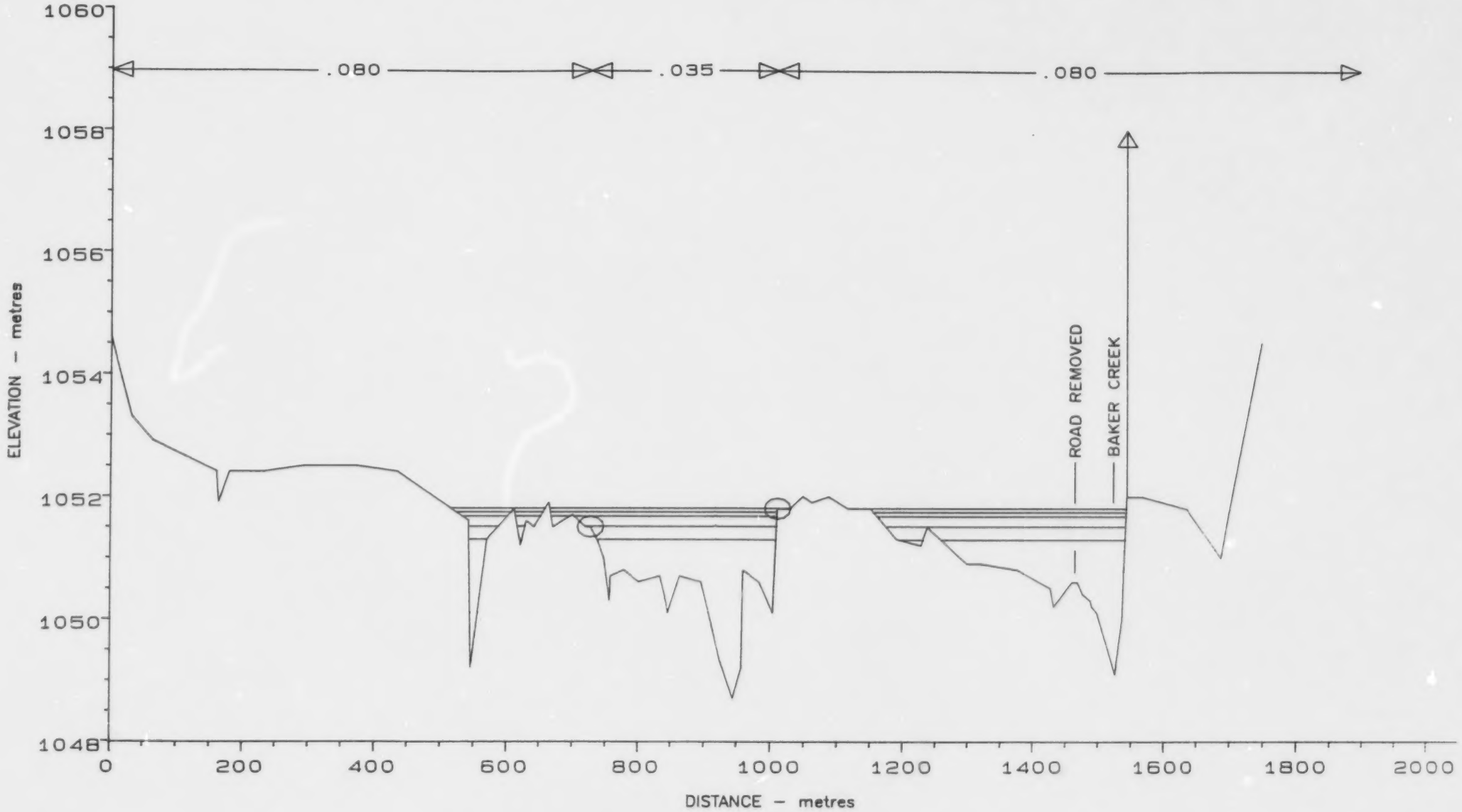
NHCL 5392–207

ALBERTA ENVIRONMENT

CROSS SECTION 7
HIGHWOOD RIVER NEAR HIGH RIVER

Scale as shown	91–05–27	FIGURE A.7

northwest hydraulic consultants ltd.



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
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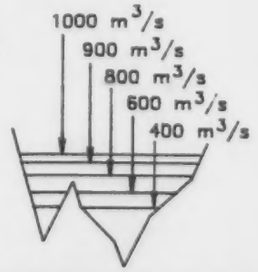
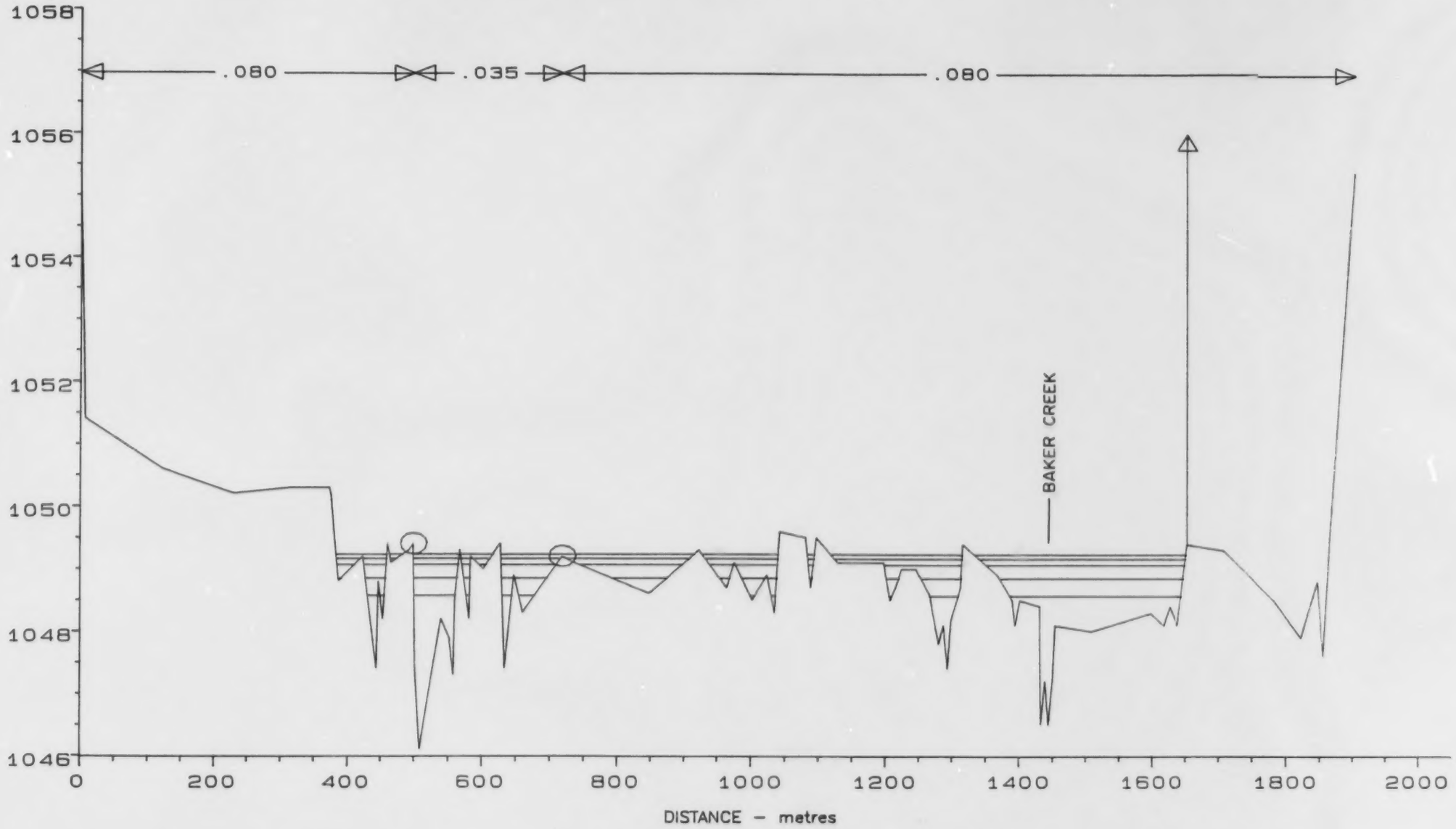


NHCL 5392-208

ALBERTA ENVIRONMENT		
CROSS SECTION 8 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91-05-27	FIGURE A.8
northwest hydraulic consultants ltd.		



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
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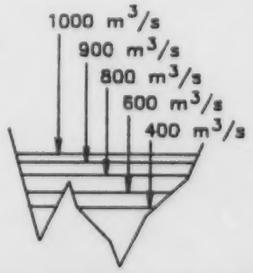

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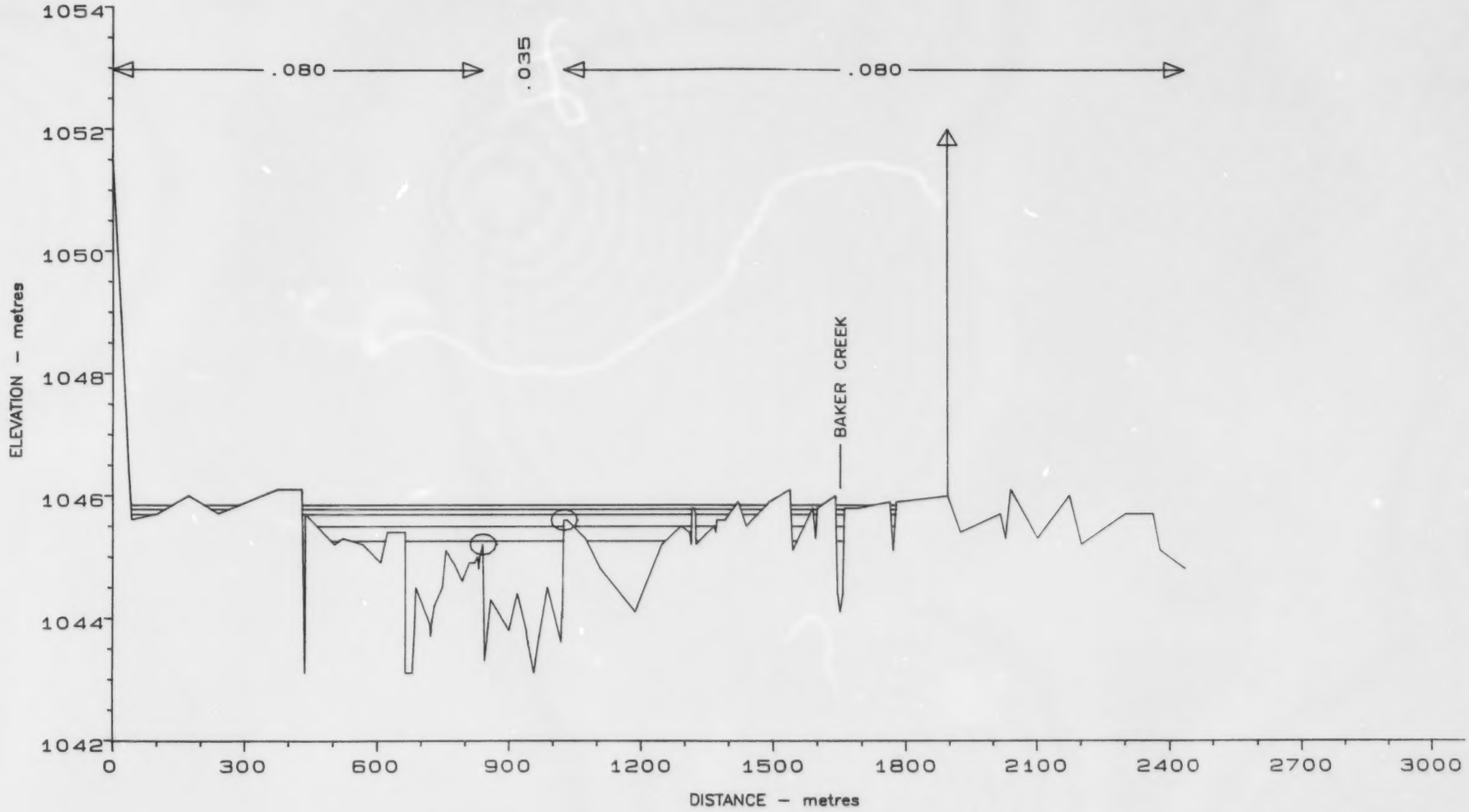
ALBERTA ENVIRONMENT		
CROSS SECTION 9 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91–05–27	FIGURE A.9
northwest hydraulic consultants ltd.		



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
SECTION SURVEYED BY NCHL IN 1974.

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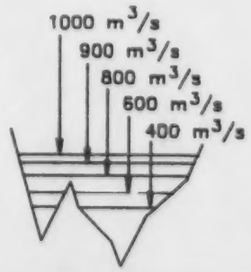
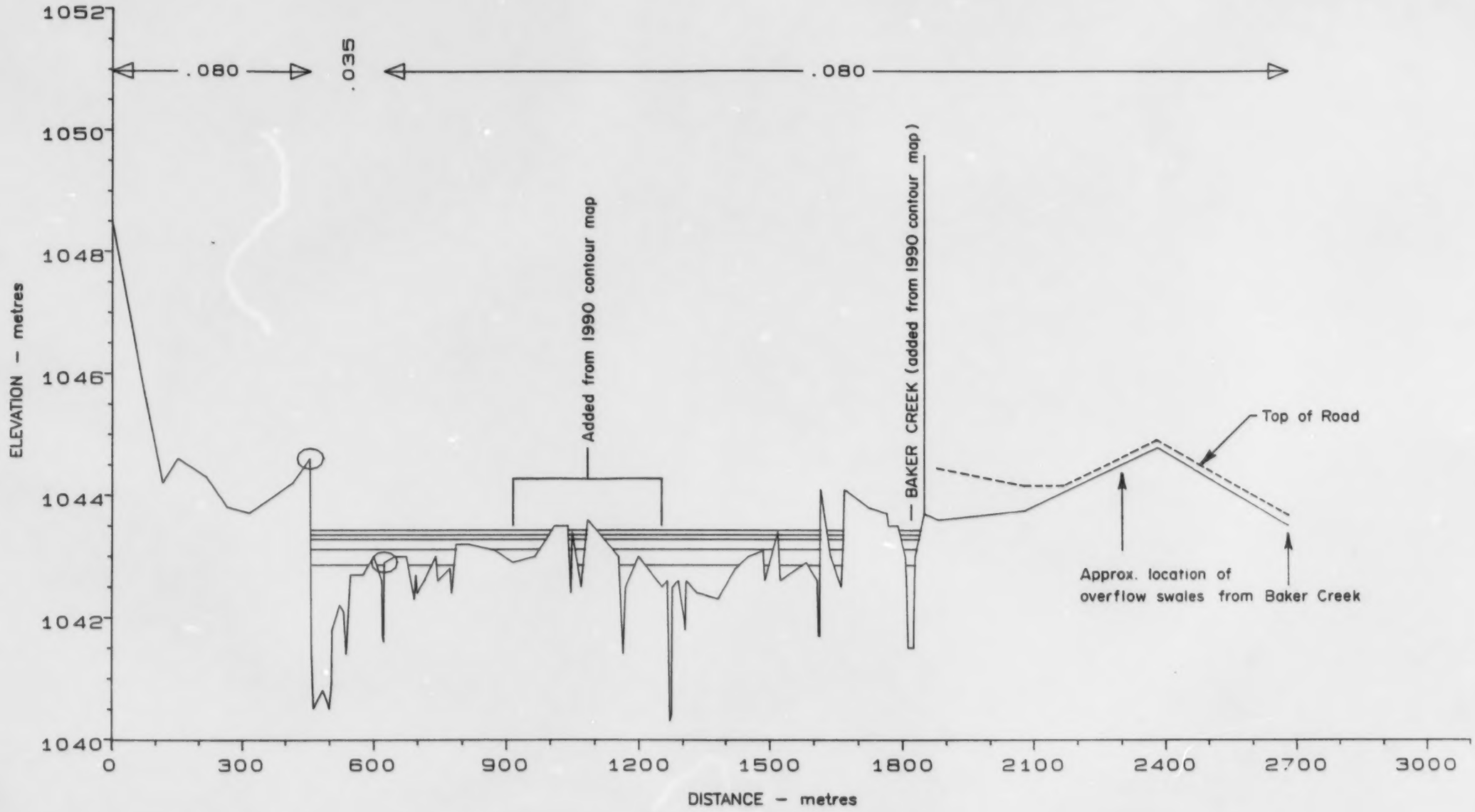


ALBERTA ENVIRONMENT		
CROSS SECTION 10 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91-05-27	FIGURE A.10
northwest hydraulic consultants ltd.		

NHCL 5392-210



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
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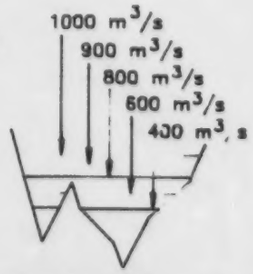
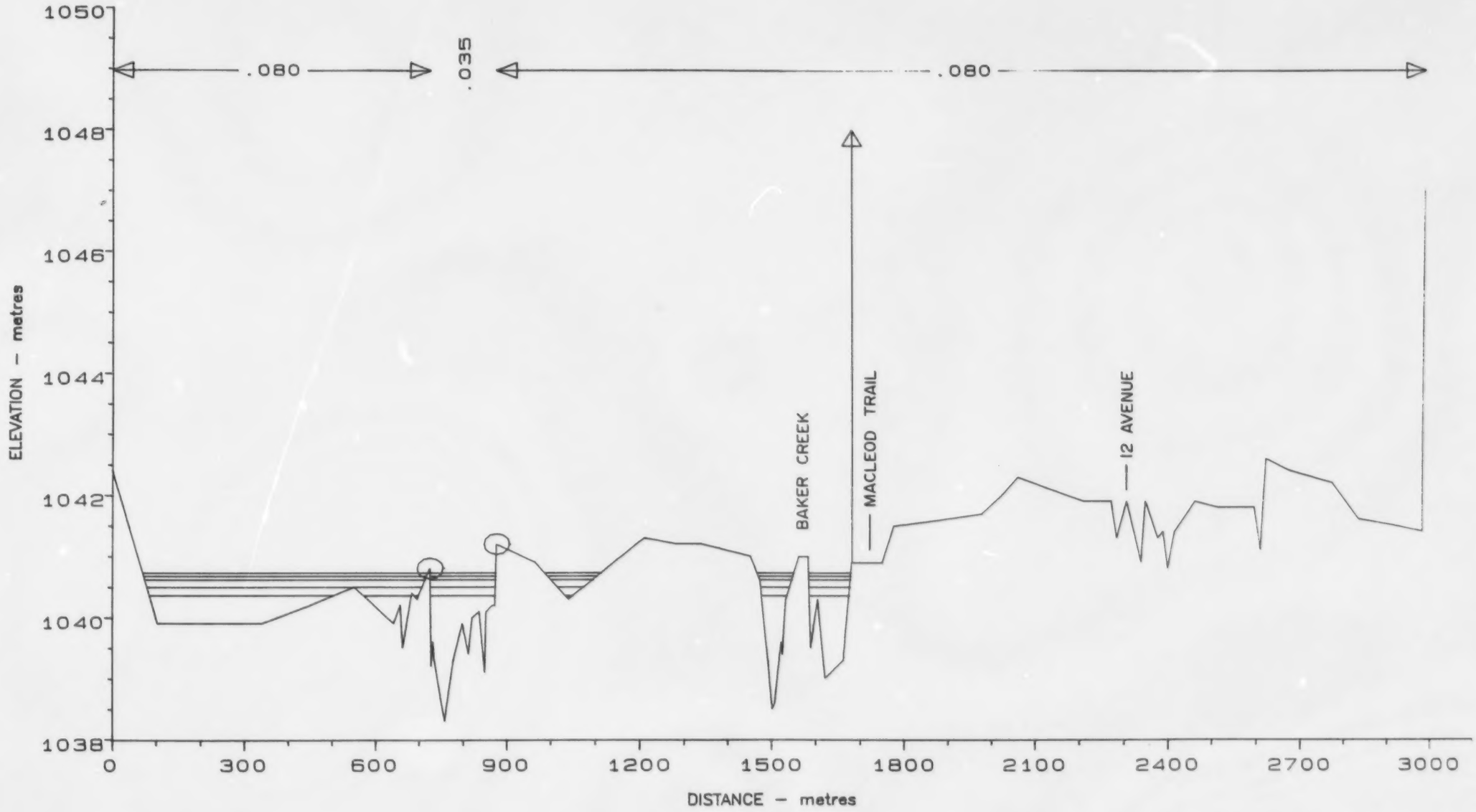


ALBERTA ENVIRONMENT		
CROSS SECTION 11 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91-05-27	FIGURE A.11
northwest hydraulic consultants ltd.		

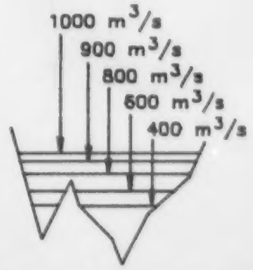
NHCL 5392-211



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
SECTION SURVEYED BY NCHL IN 1974.

LEGEND:



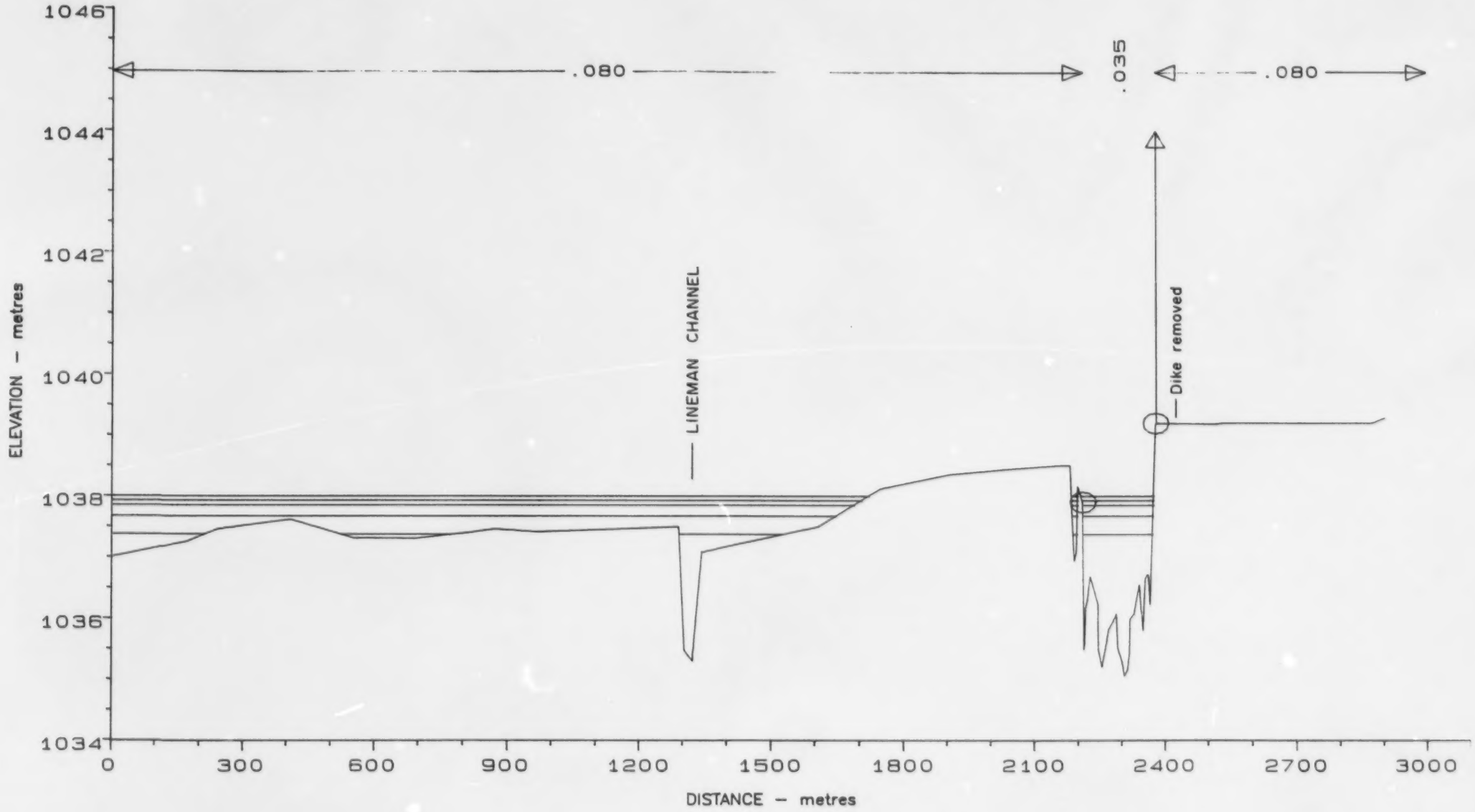
ALBERTA ENVIRONMENT

CROSS SECTION 12
HIGHWOOD RIVER NEAR HIGH RIVER

Scale as shown	91-05-27	FIGURE A.12

northwest hydraulic consultants ltd.

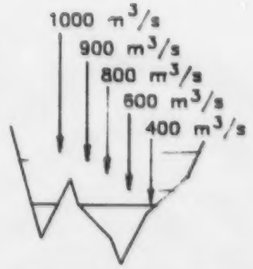
NHCL 5392-212



NOTES:

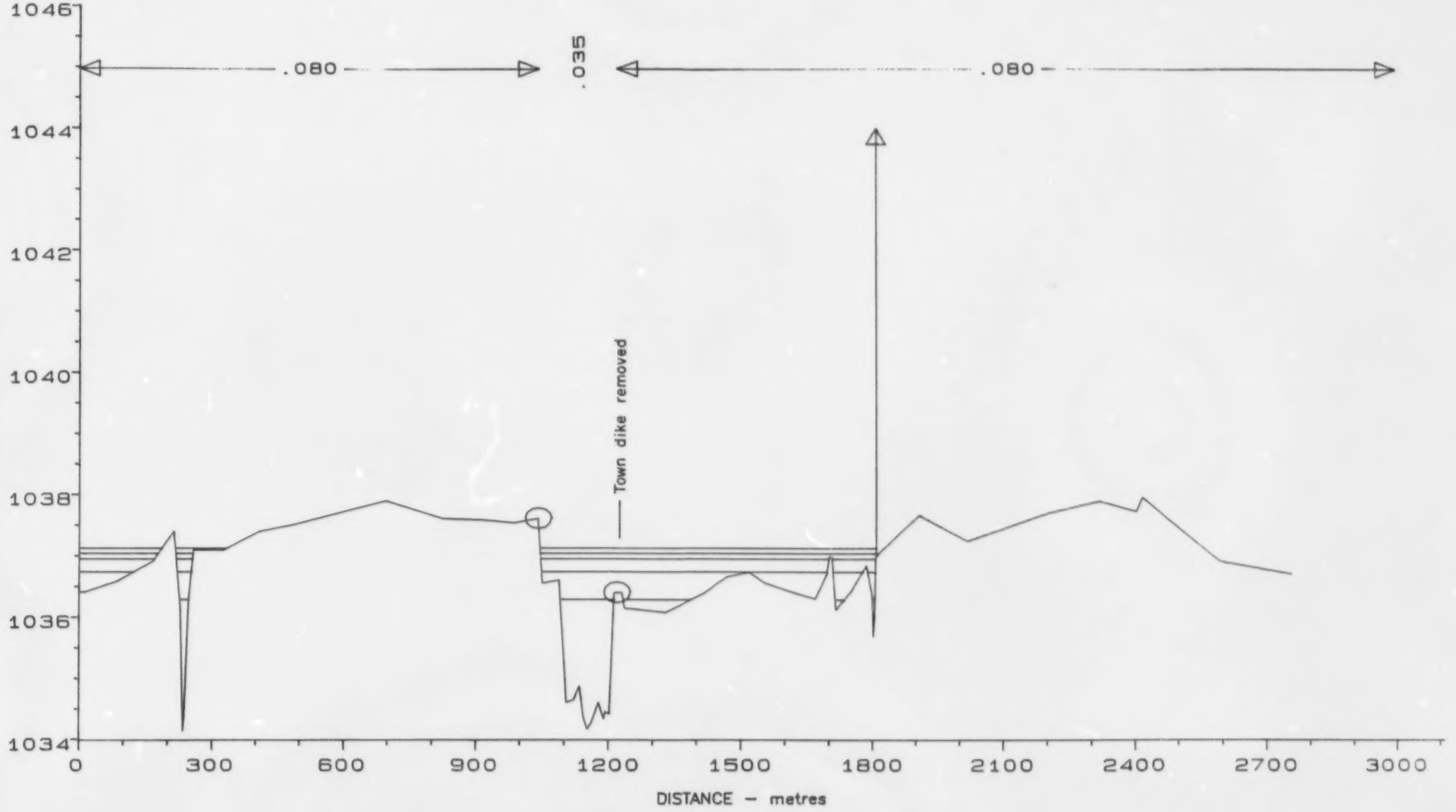
SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
SECTION SURVEYED BY NCHL IN 1989.

LEGEND:



NHCL 5392-213

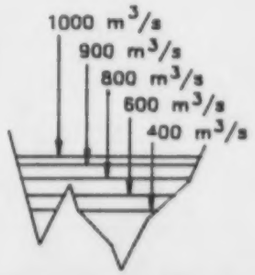
ALBERTA ENVIRONMENT		
CROSS SECTION 13 HIGHWOOD RIVER NEAR HIGH RIVER		
Scale as shown	91-05-27	FIGURE A.13
northwest hydraulic consultants ltd.		



NOTES:

SEE FIGURE 2 FOR SECTION LOCATIONS.
SECTION SHOWN VIEWING DOWNSTREAM.
SECTION SURVEYED BY NCHL IN 1989.

LEGEND:



ALBERTA ENVIRONMENT

CROSS SECTION 13.1
HIGHWOOD RIVER NEAR HIGH RIVER

Scale as shown	91-05-27	FIGURE A.14

northwest hydraulic consultants ltd.

NHCL 5392-214

Terms of Reference
Historical Aspects of Highwood River Diversion to Little Bow Basin at High River

1. Conduct a thorough search for information that would provide an understanding of the Highwood River to Little Bow River interbasin flow process during the last 100 or so years. Sources of information might include:

(a) local/regional newspaper archives;
(b) Town of High River files;
(c) C.P.R. files;
(d) W.S.C. and federal government files;
(e) provincial government files;
(f) local museum archives;
(g) review of existing technical reports; and
(h) interviews with local residents.

To some extent, this type of information search was carried out for the 1974 High River floodplain study, so it would provide a good basis to start from.

2. Prepare a list describing the historical works, from first records to the present, constructed along the Highwood River from Squaw Coulee to High River, that might have an impact on the flow pattern of the river and the interbasin flow process to the Little Bow Basin.

3. Analyze the information from items 1 and 2, to answer the following questions:

(a) to what extent have human activities (eg land clearing, road construction, rail road construction, vegetation changes, etc.) affected the interbasin flow process;

(b) why was the Hoeh dyke built and did it meet its objectives and if so, is it still meeting them today;

(c) what would happen if the Hoeh dyke were removed; and

(d) why was the Little Bow diversion canal constructed and to what extent was it built to compensate the Little Bow water users for the perceived loss of water due to the construction of the Hoeh dyke.

4. Prepare maps showing the flow pattern and diversion points at the minimum discharge level at which it is felt interbasin flow into the Little Bow Basin would begin, for both the past and present. Maps should represent conditions from 100 years ago, present day and at appropriate intermediate times, depending on which flood control measure was constructed. The information provided by these maps must be supported by reasonably sound technical argument.

5. The Hoeh dyke has been maintained during the past 75 years to protect the town of High River from flooding. The secondary concern (speculative) has been that the dyke prevents the capture of the Highwood River by the Little Bow River. Considering these points of view, provide an opinion as to whether a complete or partial river diversion might have occurred this century if the Hoeh dyke had not been maintained.

6. Prepare a report summarizing the findings.

GOVERNMENT OF THE NORTH-WEST TERRITORIES OF CANADA

DEPARTMENT OF PUBLIC WORKS

REF 1826 C

29th SEPT. 1898

REGINA 29th September, 1898.

Sir,

I beg to give you the following instructions for your guidance in performing the work required at High River.

The first work to be done is the locating of a channel to be opened out across the island between the north and south branches of High River, through which it is proposed to divert the water which now flows through the south channel and [cuts] into the bank near the Village. I enclose a blue print of a rough sketch showing location of the new channel between A and B across the island, and have to request that you will first make a rough traverse of the island and the two channels from the traffic bridge west, say for half a mile up both channels. You will then locate a line joining the two nearest points across the island, which will be found in the vicinity of the line A.B. on the sketch. On this line the difference in elevation of the water at both ends should be determined, and the necessary stakes should be placed and properly marked, for use in opening up a channel with fifteen feet width in the bottom along this line, the brush and timber being properly cleared off to permit of these stakes being placed. In making a traverse of the island as above mentioned, a line of levels should be run up both channels to determine the fall of these channels. When this work is

R. W. McIntyre, Esq., C.E.,
Irrigation Surveys,
High River,
Alta.

work is completed, make a plan on a large scale showing all information obtained, and send it here at the earliest possible date, as it is desired to put the work of opening up this channel in hand without delay.

After you have completed the above work, take a careful survey of the ditch which has been constructed by Mr. W.Robertson from the point of intake on High River to the east side of the Railway line at a point where water can be delivered from the ditch into the head of the Little Bow River. This point will be to the immediately adjoining the Railway line on the east side, and from there make a survey of the Little Bow River for half a mile down stream. The object of this work is to enable us to make arrangements with Mr.Robertson to use his ditch to divert fifty cubic feet of water per second from High River into the Little Bow, and your survey should be sufficiently complete to enable plans and profiles to be prepared to show how much the present ditch will need to be enlarged, and also to design permanent head works for the ditch and a proper spillway at point where water is to be delivered into the channel of the Little Bow, together with a bill of quantities and a estimate of cost of the complete works, and it is desirable that we should have this information at the earliest possible date.

I am, Sir,

Your obedient servant,

Deputy Commissioner.

(2)

GOVERNMENT OF THE NORTH-WEST TERRITORIES OF CANADA

DEPARTMENT OF PUBLIC WORKS

REF 1894. E.

OCT. 12. 1898

REGINA October 12th., 1898

Sir,

I beg to acknowledge receipt of your reports of the 8th., and 9th., instant relative to the work performed by you at High River in locating new channel across the island for the purpose of diverting flow of the southern channel at High River, and also to your survey of the irrigation ditch constructed by Mr. Robertson to provide information for our use in utilizing this ditch to divert the water from High River into the Little Bow.

The work as performed by you is quite satisfactory, and I have to request that you will at once proceed to High River and instruct Mr. Chas. Schaak to undertake the opening up of the new channel across the island and also the enlarging of Mr. Robertson's ditch from the point of intake to a point in the vicinity of stations 17 & 18 at which it has been decided to divert the water from the ditch into the coulee, from which it can be carried into the head of the Little Bow; that is, your recommendation that the water be diverted into this coulee west of the railway track, and carried through this coulee into the Little Bow, instead of carrying it through the ditch across the railway track.

Yours

E. W. McIntyre, Esq., C.E.,

Irrigation Surveys Office,

Calgary, Alta.,

has been adopted.

In laying out the work you will kindly note that the portion of Mr. Robertson's ditch through which we are to divert water is to be sufficiently enlarged to permit of a flow of fifty (50) cubic feet of water per second, in addition to the amount which the ditch, as now constructed, will convey.

You will also please note that we have undertaken to construct headworks for this ditch, Mr. Robertson turning over to us the timber which he has now on the ground for the headworks which he proposed to construct, as well as timber for traffic bridge over the ditch which he proposed to erect on the Shaloed trail. You will therefore design a permanent head-gate for the enlarged ditch, which will be placed at the point where Mr. Robertson intended to locate his head gate, and will arrange with Mr. Schaak to undertake the construction of this head-gate in connection with the other work of enlarging the ditch. Any additional material required for this head-gate will be obtained from Mr. John Lineham, M.L.A., at Ghetcha, an order for same being enclosed herewith.

In designing this head-gate, as well as the spill-way where water is to be diverted from the ditch, and for which material is also to be obtained from Mr. Lineham, you will, of course, design structures which will be of a permanent character and at the same time as inexpensive as possible.

It will probably be well that after getting Mr. Schaak started at work enlarging the ditch and opening the channel across the island, you should send rough

sketches

sketches showing the style of head-gate which you propose to put in, and of the spill-way, so that I may make any alterations which suggest themselves as being necessary, before work is proceeded with: but as the season is drawing to a close we cannot wait the receipt of proper plans and specifications from you before putting work in hand.

Please note that your services upon this work will be separate from those performed for the Irrigation Surveys Branch, but will be paid at the same rate, and in addition the Department will, of course, pay your living expenses while resident at High River. Forms for preparing your account for such services will be forwarded at a later date.

Your obedient servant,

Deputy Commissioner.

340

Nov. 17, 1898
November 17, 1898.

Dear Mr. Magrath,

I have your letter of the 14th instant, covering the application from Mr. John Hobson, for employment by the Alberta Irrigation Company. In reply to your question regarding Mr. Hobson's qualifications I beg to say that I know very little of him, beyond that he is the son of Mr. Hobson, the late Chief Engineer for the Grand Trunk Railway, and has, I understand, had very considerable experience in engineering work, but from what I hear his difficulty has been intemperance; probably that is the reason that he is now living in a place like Maple Creek. He did a small amount of work in connection with one or two applications from that district, but I know practically nothing of his qualifications except by report. I return you his letter as requested.

Replying to your question regarding the diversion of water from High River into the Little Bow River by the North West Government, I beg to say that our scheme contemplates the construction of a ditch to divert 90 cubic feet per second from High River into the Little Bow river, and we now have the diverting ditch and the headworks connected therewith about completed, and expect to be able to turn the water into the Little Bow this winter, or, in any case, early in the spring. The idea is that by supplying the

head

C. A. Magrath Esq, D.L.S.,
Lethbridge,
Alta.

22.

head of the Little Bow with a constant stream of 30 cubic feet per second that that stream will be kept running throughout its entire length during the whole season, and will thus reclaim the large area of land for grazing purposes which cannot now be used for that purpose owing to the fact that the Little Bow dries up during the latter part of the season, and there is no water for stock watering. There is, of course, no doubt that the diversion of this water will improve the value of the lands along the Little Bow, particularly in its lower stretches, and I may add that at the request of the Stock Association we are taking up the subject of the reservation of certain blocks of land along that stream so as to make sure that cattle will be able to get to the stream for watering purposes. If there is any more detailed information regarding this matter that you would like to have, please let me know, and I will have it forwarded. In the meantime I send you a blue print copy of the general plan filed with our application which will probably give you a better understanding of the scheme than anything I can write on the subject.

Yours faithfully,

Deputy Commissioner.

File 860

(COPY)

FEB. 10. 1906

Calgary, Feby 10 / 06

Report on traverse of Highwood River and tributaries, upstream and near to Town of High River.

- - - -

At C on N.E.¼ sec. 35 there is an overflow channel connecting river and creek which is cut off from normal flow of river by gravel and detritus at head, but there is nothing to prevent the river breaking through and changing its course into creek bed at high water. The sharp bend shown on plan throws the entire force of river towards the connecting channel C and there is a fall of 9ft. between river and creek, a distance of about 1300 ft. I consider this situation is a dangerous one in present condition.

At D on N.E.¼ sec. 1--19--29--4 there is a similar channel (to C) connecting creek and river, blocked at head by gravel and detritus, but open to high water flow. There is not much danger of a permanent change here but head should be protected, in my opinion. Between C and D there is a small tributary creek supplied from springs along the banks and it evidently carried part of high-water overflow from river, although not directly connected, as far as could be seen in heavy brush and timber through which it runs.

The Lumber Co. have two old channels of the river dammed as shown on plan (N.W.¼ sec. 1--and N.E.¼ sec. 1). The lower dam was built to divert the river from its natural course north, but I believe the upstream dam was built across a dry channel. In order to supply the Little Bow diversion ditch from the creek shown on plan, a structure in the nature of a dam 452 ft. in length and 6 ft. in height above present ice level will be necessary at E.

Regarding the dry coulee running through secs. 34, 35, 36 and 26--18--29--4, any diversion into this channel would have to be made from C, which is not a good location for headworks; also, a cut would be necessary on W.½ sec. 34 as shown by plan. This coulee joins the Little Bow about one mile south-east from centre line of sec. 25; it is 60 ft. wide and 6 ft. deep at crossing of C. & E. Rly.

The traverse was made with telemeter, rod and compass entirely and gave very good results in plotting.

The license granted for water diverted down Little Bow is for

60 cu. ft.

50 cu. ft. per second, so it would appear that the spring creek does not carry sufficient water to supply this amount without being supplemented from river. This could be done best through channel D where the banks are more suitable for headworks that on C.

Respectfully submitted,

(sd) R. W. Macintyre.

Copy sent for the information of Mr. E. Calder, Calgary.
Copy sent for the information of Mr. E. J. Brake, Olivet.

540

FEB. 13, 1917

February 13th, 1917.

R/F.

Sir,-

Your file 1826
21057.

Acknowledging your letter of February 5th, concerning the diversion of water from the Highwood river into Little Bow River.

I note from your letter that you have not as yet arrived at any decision as to what is to be done in connection with this matter, but that your Government has annually expended a considerable sum of money to maintain the diversion works, and that you think there is a question as to whether the persons living along the Little Bow River, and who are benefitting from the diversion of water, should be assessed at least a part of the cost of maintenance work.

I take it that there is no question as to the fact that the diversion of this water into the little Bow river is one of the utmost importance to the settlers living along its course, and that it is most desirable that by whatever means are found to be best, the diversion works should be properly maintained in the future. At the present time the right to divert this water stands in the name of your Government, and therefore in so far as this Department

it

L. C. Charlesworth, Esq.,
Deputy Minister of Public Works,
Edmonton, Alta.

File 6942.

Inspection May 7th. and 8th., 1917.
Diversion from Highwood river to Little
Bow river at High River.

Reasons for Inspection.

It is considered that the Provincial Government license to divert water from the Highwood river into the Little Bow river should be maintained in an effective condition. It has been stated by the Provincial Authorities that great difficulties have been met with in doing this, owing to the difficulties of maintaining efficient diversion works caused by the extreme flood conditions in the Highwood river and the very shifting nature of its bed. The intake works at present are not effective and the Provincial Authorities have indicated that before undertaking any repair work or new construction, they desire to have assurance that such will prove permanently effective.

Observation.

A preliminary eye reconnaissance was made of the stretch of the Highwood river bottom shown on the plan signed by A.H. Young, Dom.L., 1915 (Provincial Government File #23187) and further up the river to a point in Lsd.22, Sec.19, Twp.20, Rge.1, W.5th.Mer. The diversion canal and the Little Bow river were also observed to a point near the south boundary of High River townsite.

General Observations.

In the vicinity of High River and above the lowest possible point of diversion the Highwood river runs

Through a

through a wide flat bottom averaging probably three quarters of a mile in width. The indications are that in time past the river bed has meandered through this bottom changing its course from side to side and it is considered that it will continue to do this and in future time may change its course to any position within this wide bottom unless controlled by training works. The topography is such that water from the diversion can easily be diverted into the little Bow anywhere from the line of section A down to the townsite of Fish River.

It is considered that to have an assurance of a permanently effective diversion the essential feature is to establish the intake at some point whereby natural or artificial control the river cannot meander away from the intake or erode its bed away so as to leave the sill of the intake structure above the elevation of the river bed.

The reconnaissance indicated that the nearest point where a natural control exists is in the [illegible] Gold, Geol. Northern., and from this point a diversion canal could be cheaply constructed which would be on ground safe from destruction by the floods or the meandering of the river channel.

The reconnaissance also indicated that an artificial control exists at the point on the river just north of Fish River townsite where the Canadian Pacific Railway Company's railroad bridge and the Provincial Government highway bridge have been constructed. The natural control in this vicinity is not favourable, but it is considered that because of the heavy investment by the railway and

railway and government in constructing these bridges that the river will always be controlled and forced to flow through the channel at this point now bridged.

Conclusions.

(1) It is not possible to repair or reconstruct the present diversion canal or works with an assurance of permanent effectiveness because the river cannot be controlled at this point at any reasonable cost. (The same remarks apply to the necessary intake in the N.Z.'s Sec.33).

(2) In order to create permanently effective works alternatives "A" and "B" as below are recommended for further consideration.

Alternative "A".

Accept the Canadian Pacific Railway Company and Provincial Government bridge crossings as a satisfactory point of artificial control on the Nighwood River and by constructing intake works at this point and a pipe line divert the water into the Little Bow River.

Refer to Plan No.1 and profile. The contemplated works are to carry 50 c.f.s. at the extreme low stage of the Nighwood. A simple concrete intake would be constructed joining on to the Provincial Government bridge pier and containing a strong gate valve. A 42" steel stave pipe would be laid emptying into the Little Bow, which would be deepened somewhat to give a free outlet to the river. The total cost of this work has been roughly estimated at $10669.00.

As a matter of economy it is suggested that at first only the concrete intake and about 30 feet of pipe be

built at

built at the Highwood and the water then run through an open cut to the crossing of the old creek channel near the corner of 5th. Street and 1st. Avenue by the pipe line as shown on plan No.1. This open cut could follow the old creek channel or the route of the proposed pipe line without doing any harm as this part of the townsite is not built on at present. The total cost under these conditions has been roughly estimated at $4618.00.

Provided that permanent right of way for this open cut could be acquired at a reasonable cost there is no reason why this should not be maintained permanently which would save the cost of the pipe line over this distance.

"Alternative "B".

Go up the Highwood river until a point of safe natural control is reached and then construct diversion works and an open cut canal in a location safe from any damage by flood, which will divert water into the Little Bow River. (See plan No.2.) This plan indicates the location of the intake works, the main canal, and the natural channel emptying into the Little Bow. The plan also indicates the land which could be irrigated from the canal and suggests that the owners of this land might be willing to co-operate in the construction and share the cost. No survey has been made of this alternative so that no reliable estimate of cost can be given. The eye reconnaissance indicates that the sandstone ledge at the proposed intake is thick enough to form a permanent control without any works in the nature of a dam across the river.

Assuming this

Assuming this to be correct it appears that it would be necessary to construct about seven or eight miles of ditch, costing not more than $1000. per mile, and works at the intake costing say $2000.

F. H. Newell

Commissioner of Irrigation.

G.B.4.

DEPARTMENT OF THE INTERIOR
CANADA

2719 Irr.

Irrigation Branch

2719

OTTAWA. July 2. 1918.

July 2. 1918

DEPARTMENT OF THE INTERIOR IRRIGATION JUL 9 1918 BRANCH CALGARY, ALTA

Sir,

I am sending you a copy of a letter which I have just sent Mr. Charlesworth, Deputy Minister of Public Works, at Edmonton, regarding the restoration of the works for the diversion of water from Highwood river to Little Bow river. I am also sending you a copy of a letter which has been received from P.E.Mansell, solicitor for the town of Cardston. I understand that Mr.Mansell also wrote you on the 22nd ultimo regarding the matter, although I have no report from you to this effect.

In the department's reply to Mr.Mansell it was made clear to him that the works for the diversion of water from Highwood to Little Bow river were originally constructed by the Government of the Northwest Territories and later on taken over and have been since maintained by the Government of the province of Alberta; that it would appear to be the duty of the Provincial Government to restore these works in order to protect the water supply of the residents in the Little Bow valley.

There are two sides to this question at present. The first respecting the protective works constructed by this department in Highwood river in the autumn of 1917; if these works hold, and prove effective for the purpose for which they were constructed, it would apparently be necessary that someone should reconstruct the works for the diversion of water to the Little Bow, or, otherwise, the residents along the course of that stream will be in dire straits from lack of water.

On the other hand, if the protective works should fail, a considerable portion of the flow of Highwood river will naturally find its way into the channel of Little Bow river, thus relieving the water shortage along the course of the latter stream but incidentally causing very serious damage to property. In this case it would be necessary to consider the reconstruction of the protective works.

The whole question is perplexing, and I am by no means clear that it is any part of the duty of the Dominion Government, or, indeed, of the Provincial Government, either to construct protective works along the course of Highwood river or to construct works for the diversion of water from Highwood to Little Bow river. Under ordinary conditions I am of opinion that

The Commissioner of Irrigation,
Department of the Interior,
Calgary, Alberta.

MEMORANDUM.

On the 26th instant in company with Mr. Charlesworth and Mr. Calder, I went to High River to determine the best means of overcoming the difficulty of diverting water from High Head river to Little Bow river.

It had been proposed that this department in co-operation with the Provincial Government should put in headgates at a point where our protection work was constructed last year. It was found, however, upon examination of the site of the old diversion works of the Provincial Government, that the sand and gravel bar which had formed in front of their headgates, could be opened up from the headgate to an overflow channel on the river, and enough water secured by this means to meet present needs. The Provincial Government, has, therefore, started work on this diversion located on the NE. ¼ of section 35, township 18 , range 29, west of the 4th meridian. They are also strengthening the temporary dam at the mouth of Baker creek for diverting water into Little Bow canal in NE. section 1, township 19, range 29. It will, therefore, not be necessary to divert water at the point where our protection works were constructed.

On the 25th instant, Mr. Ballachey of High River called me on the 'phone to say that some of the farmers in that district were protesting against the work which was to be done by the Provincial Government in diverting this water, fearing that damage by flooding would result. It was their understanding, as reported to me, that the Provincial Government was going to cut the dyke which we had built. After seeing the work on the 26th, I interviewed Mr. Ballachey and informed him that the work being done by the Provincial Government was within their rights, and that no danger from flooding will result from this work.

Examination was also made of a point in NE. of section 1, township 19, range 29, near the centre of the quarter section marked "dam" on the map prepared by Mr. Young of the Provincial Public Works Department. It is possible with very little work to divert water which is flowing through a flood channel at this point, by putting in a headgate in an old dam constructed by the Limchen Lumber Co., which would divert water to flow through a flood channel into Baker creek above the diversion into Little Bow canal. In case it had been found not possible to divert water through the Provincial Government headgate in NE.sec.35, I proposed to recommend the diversion at the point in NE. sec.1. described above. It would be less expensive and be attended by less risk than a diversion at the point where our protection works were constructed.

J. K. Ross.

Assistant Chief Engineer.

these works should be constructed and the cost borne by the people who are directly interested. I have, however, referred this phase of the matter, which, after all, is one of policy, to the Acting Minister of the department for an opinion. I will advise you as soon as I learn the Minister's views.

In the meantime I should like to have an immediate report from you regarding:

(a) The manner in which the protective works are holding in Highwood river; and

(b) What prospect, if any, there is that the Provincial Government will undertake to restore the diversion works at an early date.

In this connection let me suggest to you that when representations are made to you in connection with a matter of such serious and immediate importance as that in Mr.Russell's letter to you of the 22nd ultimo, you should at once report the matter to the department, together with a statement of your views.

Your obedient servant,

C. J. Stuart

Superintendent of Irrigation.

(Copy for the Commissioner of Irrigation, Calgary. File 540.)

DEPARTMENT OF THE INTERIOR.

Irrigation Branch.

S.E.A. 2070 Irr.

July 2, 1918

Ottawa, July 2, 1918.

MEMORANDUM:

The correspondence hereunder from Mr.F.H.Russell, Carmangay, regarding the reconstruction of certain works for the diversion of water from Highwood river to Little Bow river, opens up a very interesting question as to the relative responsibilities of the Dominion and Provincial Governments in this or other similar cases. A brief recapitulation of the facts in this case is necessary to a clear understanding of the situation.

Back in 1898 the attention of the then Commissioner of Irrigation (Mr.J.S.Dennis) was drawn to the scarcity of water in the Little Bow valley, and to the possibility of augmenting the county supply by comparatively inexpensive works which would divert a portion of the flow of Highwood river to the upper course of the Little Bow, whence it would flow down the valley of that stream to supply water for domestic and stock watering purposes.

Mr.Dennis was, also, at the time Deputy Commissioner of Public Works for the Government of the Northwest Territories, and, acting in these dual capacities, had the necessary surveys made and the works actually constructed for this diversion of water. An application was submitted by the Territorial Government for a water right and in due course of time, when the works had been completed and all the formalities complied with, a license was issued in August, 1903, in favour of the Government of the Northwest Territories. The long delay between the initiation of these works and the actual issue of the license was caused by the erratic behaviour of Highwood river, which necessitated somewhat serious changes in the plans.

From the date of the completion of these works and the issuing of the water license the Government of the province of Alberta has assumed responsibility for the maintenance of the works and has several times repaired or reshaped them when they were injured or destroyed by flood, and has not even at the present time, so far as I understand, repudiated its responsibility for them.

S.E.Gory, Esq., K.C.,
Deputy Minister,
Department of the Interior.

During this time the town of Carmangay has installed a water supply system taking water from Little Bow river and at the same point the Canadian Pacific Railway Company also has a water right for industrial purposes, the water in both cases being pumped from the stream. As, however, the ordinary flow of the Little Bow river is insufficient for such purposes, the water used by the town and by the railway company is actually Highwood river water, although diverted directly from Little Bow river. Both these water rights were granted by the Dominion Government, under the provisions of the Irrigation Act, but out of water diverted by the Provincial Government from Highwood to Little Bow river.

The Provincial Government's diversion works have for some time past been out of commission. The intake has been badly damaged and as the main channel of Highwood river has changed its course and is, in fact, frequently changing its course, the Provincial Government has been indisposed to restore the works pending some comprehensive and satisfactory plan for confining Highwood river to a specific channel so as to avoid the constantly recurring necessity for altering, extending or restoring the diversion works.

During 1917, as the result of repeated freshets it became apparent that unless some protective works were constructed Highwood river was likely to leave its course and cut across country to the headwaters of Little Bow river and flow down the channel of that stream rather than in its normal course. The construction of protective works was believed to be necessary in the public interest as if the danger anticipated had been realized the damage to property and other interests would have been very great; much valuable farming land would have been destroyed, the water supply works of the town of Carmangay and the Canadian Pacific Railway Company at Carmangay would probably have been destroyed or seriously damaged, and, in addition, the town of High River and other interests along the lower course of Highwood river would have been seriously affected by deprivation of water. Therefore, the Dominion Government expended some $8,000 in the construction of protective works. The work was done hurriedly, under peculiarly unfavourable conditions, late in the autumn of 1917, and these works have not yet been thoroughly tested by flood, so that their effectiveness is at present unknown. A report received just a few days ago from the foreman over indicates that the present high water is seriously endangering these works, and there is a possibility that the river may change its bounds and cut across to the channel of Little Bow, notwithstanding the protective works.

Representations have now been made on behalf of the authorities of the town of Carmangay that the works for the diversion of water from Highwood river to Little Bow river should be restored, as the residents along the course of the Little Bow are in serious straits owing to lack of water. There is practically no flow in the Little Bow river except during periods of high water and flood.

Two things are, obviously, necessary:

1. To protect the channel of Highwood river by additional works, if necessary, or by strengthening the existing works so as to prevent that river leaving its present channel.

2. The restoration of works for the diversion of water from Highwood river to Little Bow river to provide for the domestic rights of the settlers along the course of the latter stream.

The question naturally arises: who is responsible for the construction of such works, and to what extent, if any, are the Dominion or Provincial Governments responsible.

In so far as the protective works are concerned, I am of opinion that under ordinary conditions the locally interested parties, assisted by the Provincial Government, should bear the cost, although the works should be constructed under plans to be approved by the Minister of the Interior. I have coupled the Provincial Government with the locally interested parties, for the reason that that Government has a considerable investment in roads, bridges, etc., which would be seriously injured if the river should leave its course. I am of opinion that the Provincial Government should protect its own investment. The Dominion Government undertook the work last year only as an emergency measure. The danger was imminent and the time would not permit of arranging for co-operation on a cost-sharing basis among all of the interested parties; moreover, the Provincial Government at that time declined to bear any portion of the cost, holding that the Dominion Government controlled the question of water supply under the Irrigation Act and, therefore, should assume responsibility. The town of High River and some of the locally interested persons did, however, give some financial assistance.

Regarding the works for the diversion of water from Highwood to Little Bow rivers, I am of opinion that, inasmuch as the town of Carmangay and the Canadian Pacific Railway Company are vitally interested in the maintenance of an adequate supply of water in the vicinity of the town of Carmangay, they, with the assistance if it can be obtained of the rural municipalities along the course of Little Bow river, should assume responsibility for the reconstruction and maintenance of the diversion works, and that application should be made by them for a right to divert water from one stream to the other through works to be constructed under the Irrigation Act, with the approval of the Minister of the Interior.

It does not seem to me that the Dominion Government should assume financial responsibility for providing a water supply for towns and railway companies even under such peculiar conditions as these. If that principle were admitted it is hard to say where it would lead, as there are many towns in almost as difficult a position as Carmangay.

The question is, admittedly, a very difficult one; both the flood menace and the shortage of water supply are critical, and prompt action of some kind is absolutely necessary. I have taken the question up with the provincial authorities, with a view to ascertaining whether they are now willing to reconstruct their diversion works, and I have also taken it up with the Commissioner of Irrigation and have asked for a full report:

1st. As to the adequacy of the existing river protection works; and

2nd. As to the probable cost of reconstructing the diversion works.

In the meantime, I am submitting the matter to you for an opinion as to the responsibility of the Dominion Government in connection with these two phases of the question. I should like to know whether, in the event of prompt action being found necessary, and the Provincial Government being unwilling to act, you consider that the Dominion Government should spend any further money in improving the existing works for the protection of the channel of Highwood river, or in reconstructing the works for the diversion of water to Little Bow river.

See sketch herewith. R.F.B.

Respectfully submitted,

R. F. Rocke

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February 5-1919

MD/P.

February 8th, 1919.

Sir,-

2979 R.B.

In further reference to your letter of December 30th, authorizing me to make surveys so as to determine what steps should be taken next year in the event of our department desiring to turn water down through the Little Bow diversion canal, in order to serve riparian owners down the Little Bow river.

I looked over the situation at Nigu River on the 31st ultimo, and would report as follows: I think it may be taken for granted that as a temporary measure the only feasible way to divert water out of the Highwood to the Little Bow, is to first divert the water into Baker creek, and then out of Baker creek through the Little Bow ditch. I also think it may be taken for granted that if it is feasible at a reasonable cost to do so, it would be desirable to divert the water from the Highwood into Baker creek, by utilizing some other means than the old headgates and channel which were utilized by the provincial government this year.

Some prior information which I gained from Mr. F. G. Porter, confirmed by this recent personal inspection, shows that it is very feasible at a very small cost to divert water out of the Highwood into Baker creek, through an old channel the location of which is roughly indicated on the blue print plan attached hereto. You will note that this channel drops 4 to Baker creek about 1000 feet above the intake to the Little Bow ditch. The water is at present stopped from coming through this old channel by old pile and rock and brush protection, which was presumably put in by the Limeburn Lumber Company some years ago. I judge that not more than fifteen man days work will be quite sufficient to open this channel up and leave it so that it would be fairly safe against any undue erosion or flooding, caused by a possible flood in the Highwood river.

The problem would then still remain of diverting water out of Baker creek into the Little Bow ditch. I am not attempting to estimate what time would be necessary in this respect, because the whole question depends upon the conditions which may be found existing after the spring floods in the Highwood river next year. It is quite possible that the flow of the

[illegible]

The Director, Reclamation Service,
Department of the Interior,
Ottawa.

constructed last year by the provincial government will still be sufficient for this purpose, with possibly a very small amount of repair work. Probably this dyke will be breached for a length of from twenty-five to seventy-five feet. If this occurs and the channel of Baker creek are not at the same time badly scoured as to make it difficult to borrow material, the best course would be to rebuild the dyke. Under certain other conditions, in the event of a very high flood, it might be necessary to put a small dam across Baker creek and build from 500 to 900 feet of flume to divert water into the ditch.

Under these conditions it would seem unwise to try to make any definite arrangements at the present time. I am satisfied that the diversion into Baker creek will be satisfactory and the proper one to open up, and the question of just how to divert water out of Baker creek will be settled in short time, after the floods are over and it is possible to observe conditions which then exist.

Your obedient servant,

.....
F. M. Peters.
Commissioner of Irrigation.

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Morning Albertan
July 2 '19

LITTLE BOW RIVER COMPLETELY DRY

Settlers Are Severely Up Against It for Water for the Stock

Special to the Albertan.

Lethbridge, Alta., July 1.—The dry spell has completely dried up the Little Bow river, and the farmers are up against it for water for their stock. As a result, 200 head were moved out of the district on Saturday. The farmers contend that, according to a treaty had by the provincial government from the federal government, water could be turned into the Little Bow from the High river. In spite of the attitude of the government being called to the state of the Little Bow, the farmers maintain that no action has been taken.

There are about 1,000 settlers along the Little Bow. The proposal is estimated to cost $2,000. The farmers bitterly resent the action of the provincial government in throwing over the responsibility for the work apparently for getting the water to them, without proceeding directly to the matter.

HOMES AND OFFICES OF LOCA LLABOR LEADERS

DEPARTMENT OF THE INTERIOR.
IMMIGRATION BRANCH.

Department of the Interior

IRRIGATION DIVISION

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CALGARY, ALTA.

KR/JBB

UNIVERSITY OF ALBERTA
JUN 25 1934
CALGARY, ALTA.

Memo. to the Acting Commissioner.

With reference to the cancellation of the abandoned works originally constructed by the Province of Alberta for the diversion of water from the Highwood river to the Little Bow river for domestic purposes, and to Mr. F. R. Burfield's report of his inspection made on May 7th, I visited these works yesterday and made a careful examination of the situation as it exists at present, and would report as follows:-

Lower Point of Diversion.
NE.1-19-29-4.

As stated in Mr. Burfield's report, most of the piling at the mouth of Baker creek has been washed out so that there is now no possibility of diverting the river at this point except at high stages. At the present time the piling extends out from the south bank of the river for about 60 feet in line with the left bank of the old diversion canal to the Little Bow river, as shown on diagram No.1 attached and due to the impact of the water is beginning to weaken and will probably go out if the river gets much higher. The river striking this piling causes an eddy which has cut into the bank at the mouth of the diversion canal, but there is no danger of the river cutting through this old canal to the Little Bow river. The danger here is that the river after washing out this 60 feet of piling will then cut into the bank below the mouth of this old canal and eventually wipe out the High River park as indicated on diagram No.1. The river bank is much lower below the mouth of the Little Bow diversion canal than above it and the impact of the current here at the present stage of the river is tremendous due to the sudden bend of the river at this point.

Since Mr. Burfield's inspection an earth fill, presumably built by the Provincial Government, has been placed across the Little Bow diversion canal at the point shown on diagram No.1, so that there is now no danger of the river cutting through here due to the existence of these old works. The fill has a 12-foot top with 1½ to 1 slopes and is riprapped with rock and brush on the upstream face.

Upper Point of Diversion.
NE.32-18-29-4.

Mr. Burfield in his report of May 9th last states as follows:-

"Here the water yesterday was just lapping into the head of the ditch and water was standing in the ditch for about 150 feet. Beyond that the ditch is partially filled with gravel and sand, and in its present con-

"dition and water would merely flow around the gravel bar and return to the river. If it rose to a sufficient height to leave the gravel bar and flow through the brush, the diversion through the ditch would be insignificant compared with that over the gravel bar itself."

Yesterday, water was standing in the ditch held back by the headgate, and there was a considerable flow around the gravel bar returning to the river lower down as indicated in diagram No.2, and I agree with Mr. Burfield that when the river rises to a sufficient height to leave the gravel bar and flow through the brush most of the water which enters the canal from the river being checked by the headgate will flow over the gravel bar and back to the river.

Since Mr. Burfield's inspection the headgate has been filled in by the Provincial Government and although some water is still seeping through the foundation of the structure under the fill and flowing to Baker creek, in so far as the flow which comes from the river through the canal is concerned there is very little danger. For some distance above the mouth of this old diversion canal the river banks are low, in some places even lower than at the point where the canal leaves the river. It is here that the danger lies. Water coming over these banks would find its way to the old channel below the headgate and soon cut for itself a channel linking up this old channel with the Highwood river and possibly undermining the old headgate and existing fill. In this event there would be grave danger of the whole river being turned down to Baker creek and eventually to the Little Bow.

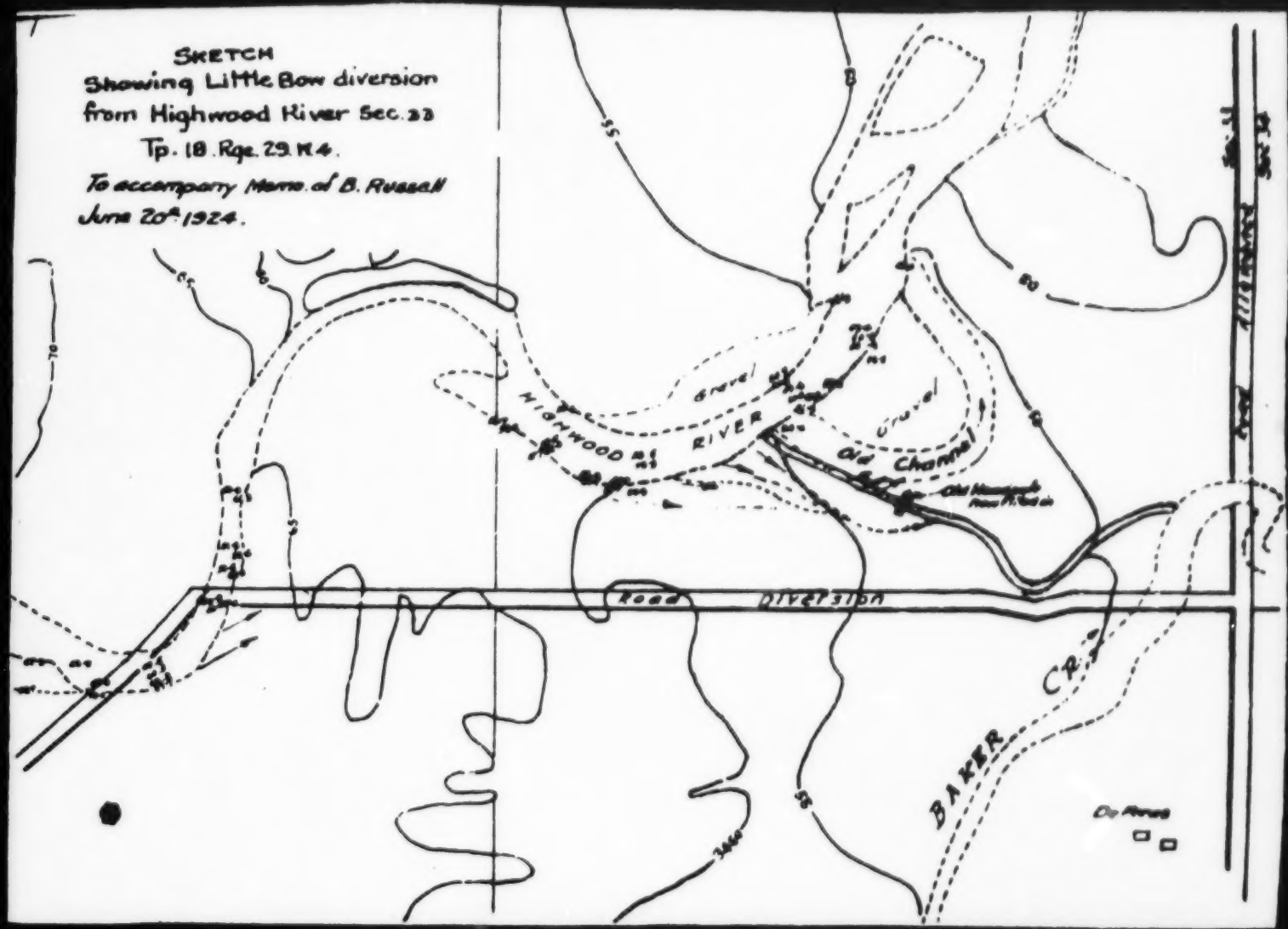
Before steps are taken to cancel the application of the Province to divert the Highwood river at this point, serious consideration must be given to the conditions as they existed previous to 1903 when the first works were constructed, and as they exist at the present time.

When the original diversion works were constructed the main channel of the river made a sharp bend to the east at the point of intake as shown on diagram No.2, so that the point where the headgates are located was then the river bank. There was, as I have been informed by those who have known the river for many years, at that time no channel whatever connecting the river with Baker creek. The surface here was practically level and overgrown with heavy brush, so that although the river in flood undoubtedly overtopped its banks along here, the water went over in thin sheets and due to the heavy undergrowth, did not concentrate in any one channel, so that there was not much danger of it changing its course at this point through to Baker creek.

By cutting a canal from the river through to Baker creek, the Provincial Government have entirely changed these conditions. The water which has been flowing through this channel now for a number of years, sometimes controlled and sometimes not, has now cut a wide and deep channel from the headgates to Baker creek and there is no question but that the existence of this channel is a serious menace, in that the water which flows over the river banks above this point of intake is bound to concentrate in this channel and if not controlled will eventually cut back to the river bank.

From these considerations I cannot agree with Mr. Barfield that there is no reason why these works should not be cancelled and would recommend that these works should be cancelled only under the condition that the Provincial Government assume the responsibility for damages by flooding due to the existence of these old works.

A. B. Russell
Chief Field Inspector.


SKETCH
Showing Little Bow diversion
from Highwood River Sec. 33
Tp. 18. Rge. 29 W 4.
To accompany Memo. of B. Russell
June 20th 1924.
Gravel
HIGHWOOD
RIVER
Gravel
Old Channel
Road DIVERSION
BAKER CR.

MAPS
NOT
FILMED

CARTES
OMISES